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Electric Welding on Shipboard.

The Board of Naval Officers appointed to investigate the Thomson-Houston welding process, as heretofore stated in the REVIEW, has made a report to the department, giving full descriptions of the apparatus used and explaining the various applications of the process. The officers say, "we are convinced that it can be found of great utility to the Naval Service, both on shore and afloat, for the following reasons: It can can be used (*a*) in welding breaks in rods without altering them in length or shape; (*b*) for welding tubes; (*c*) for welding angles and shapes of intricate form; (*d*) for welding copper, brass, cast iron and other metals; (*e*) for heating metals for forging, tempering and upsetting; (*f*) for welding cables.

"Under these heads the following may be mentioned as a few of the many applications that would result on shipboard: For welding broken pump piston rods, valve stems, etc.; for joining wires of iron, copper, or other metals or bars of the same of similar or different shapes or sections; for making joints at angles with bars (T or Y joints); for mending chain and wire rope; for constructing or jointing, end to end, pipe of all kinds, and of large or small diameters; working or joining lead pipe; welding T connections or elbows into lines of piping; welding safe ends to boiler tubes; repairing boiler tubes; welding eye rings, and welding these again to bolts and bars; repairing, cutting and boring tools without hurting their temper; lengthening or shortening rods or bars; repairing broken cast iron pieces of machinery, or broken cast iron or cast brass fittings; welding electric mains. This system of welding thus renders easy many operations which have heretofore been considered impossible."

Steam Engine Foundations Embedded in Air.

Among the remarkable examples of bold engineering in the great sugar refinery of Claus Spreckels, at Philadelphia, Pa., one of the most unique is the hanging or aerial steam engine foundations. The engines used in this establishment are distributed practically all over the buildings, a large proportion of them being on upper floors. Some of these engines are bolted to iron beams or girders on second and third stories of the building, and are consequently innocent of all foundation. Some of these engines ran noiselessly and satisfactorily, while others produced more or less vibration and rattle. To correct the latter, the engineers simply suspended foundations from the bottoms of the engines, so that, in looking at them from the lower floors, they were literally hanging in the air. A foundation does service to an engine, or any machinery, it seems, by its weight alone; hence, it makes little difference whether the foundation be firmly embedded in mother earth or in the air.

Inspection Rates in Cincinnati.

The Underwriters' Association of Cincinnati has adopted the following regulation in relation to electric lighting: "From and after this date, February 17, 1890, wiring for electric lighting, either isolated plants or work which may be connected to a central station, will not be inspected by the Underwriters' Association of Cincinnati until the parties owning or occupying the property in which the wires are placed have paid in advance for having them inspected, and no permit to use the lights will be granted by the insurance companies until the wires have been inspected and found in compliance with the requirements of the Underwriters' Association of Cincinnati, and a certificate to that effect has been obtained from said Association. The rates for inspections will be as follows:

"Incandescent lights—Not over ten, $1, and 10 cents for each additional light.

"Arc lights—50 cents for each light.

"Electric motors—One horse-power, $1; over one horse-power, $2.50."

Electric Lighting for the Capitol at Washington.

Mr. Edward Clark, the architect of the United States Capitol, has made a report to the Senate committee on rules, in response to instructions to ascertain what is the best system of low voltage lighting for the Capitol building and grounds. He states that he had addressed letters requesting information and suggestions on the subject, to a number of experts on electric lighting and to the presidents of several institutions of learning in which the science of electrical engineering is taught, and his report is accompanied by the replies received by him. Professor Henry Morton, President of Stevens Institute of Technology, replied that "having intimate knowledge of the various systems of electric lighting I can answer at once and without hesitation that the system of the United States Electric Lighting Company is the most complete, economical, reliable and efficient. This system involves the lowest voltage of any in use, being much lower than the system of the Edison Electric Company, or any other system which has ever been practically developed." President Francis S. Walker, of the Massachusetts Institute of Technology, does not answer the inquiry himself but recommends a reference of the matter to the National Academy of Sciences which, he believes, could "give the best possible expert opinion which could possibly be obtained." Commander Bradford, the Superintendent of the Naval Electrical Establishment, strongly recommends the Edison three-wire system and the apparatus of the Edison Company as the best for the purpose. Superintendent Powell, of the Treasury Department, advises that "the building be wired upon a basis of the lowest voltage in present use, with a predetermined drop, in simple multiple, convertible to a three-wire system," and names the Edison, Brush, Sawyer-Man, Thomson-Houston and the United States Companies, as reliable parties to deal with. Geo. C. Maynard, of Washington, expressed the opinion that there are several systems of lighting about equally well adapted to the purpose, and suggested the preparation of full, detailed plans by the government, on which any company could base a proposal for installing the plant.

From the information received the architect reaches the conclusion that any system of low voltage lighting now in general use would be suitable for lighting the Capitol building, the differences being mainly of details, such as the character of boilers, engines, dynamos and the minor features of the plant. He estimates the cost of the necessary plant for lighting the entire building and terraces at $169,470, with an additional $50,000 for a station to be placed outside of the grounds and a large subway for carrying the wires to the building. He had received a proposition from the local company for supplying current for lamps to light the grounds at three-quarters of a cent per hour, which would be considerably more than the present cost of gas. In view of the increased cost, and the injury which the grounds would sustain in constructing subways, he does not recommend the substitution of electric lights for gas as now used.

Out of some 4,000 arc lamps that were in use in New York before the wire cutting crusade commenced, about 1,500 are in use again. The citizens unanimously want to see them all back.

The Rae "Horn" Measuring Instrument.

In electric measuring instruments it is of first importance that the controlling force is not liable to changes due to variations of temperature, position, etc. It is well-known that no controlling force is so suitable in this respect as that of gravity. The most serious objection to its adoption, however, has been the difficulty in making the deflecting force increase proportionally with that exerted by gravity, which increases rapidly as the pointer and armature leave their vertical or zero position. It is, therefore, evident that in order to obtain an "even" scale, the force exerted by current to be measured must keep pace with the increasing action of gravity. This can be accomplished in either of two ways, or by a combination of both. In the first, the armature is so situated or shaped as to move into an increasing field of force due to its situation or shape, in relation to such field; in the second, by suitably proportioning the mass of iron to the magnetizing current, the magnetization being made to increase more rapidly than the current.

THE RAE MEASURING INSTRUMENT.

A brief description of the instrument invented by Mr. Frank B. Rae will show that he accomplishes the above by a combination of these conditions. In this instrument he has a tapered, well annealed, iron core of relatively large dimensions, bent so as to be concentric with the arc of swing of armature. One portion, the upper, of this tapered "horn" is wound with wire to carry the measured current; the lower portion protrudes from windings and tapers down to a cross section, considerably less than that enclosed by helix. To the upper pole of horn and against the cheek of windings is fixed a bearing, also of soft iron, from which is freely suspended a rod of iron, attached at lower end to an iron ring, the inside diameter of which is such as to allow it to have about one-eighth inch clearance, when at largest part of horn. To the lower edge of this ring is fastened rigidly a light pointer which passes in front of scale upon which are marked the values of current in amperes. When this ring armature is in its zero position it hangs vertically and just encloses the tips of "horn." It will be readily understood that on the passage of a current, a certain degree of magnetization is imparted to tapered horn so that a pole is framed at its end opposing the ring where an opposite pole is induced, since there is a complete magnetic circuit, broken only by space between ring and tips of horn. The ring will be deflected and tend to creep up horn in order to shorten magnetic circuit. This it does until magnetizing force is balanced by pull of gravity. These instruments possess features which will not be overlooked by electrical engineers; namely, they are practically dead beat, are reliable and strongly made, and in addition are impossible to get out of order and are, therefore, desirable and to be depended on, not only at time of installing, but after years of such usage as would cripple other instruments.

They are manufactured in sizes from 60 amperes reading, to 400 amperes, of very superior workmanship and beautiful appearance, having hardwood cases, beveled glass fronts, and all metal parts highly polished and handsomely plated.

The Lockwood Instrument Company, of Detroit, are putting this instrument on the market and expect to do great things with it.

Typo-Telegraphers.

The use of the typewriter by telegraphers in copying press reports for daily papers is in the ascendency, says the Rochester *Democrat and Chronicle*. On the Western papers, at present, nothing but typewriter telegraphers are employed.

The one thing more than another which brought this about, was the placing, as senders, at New York offices of the different press associations, the most rapid men to transmit the news report, which averages from 10,000 to 13,000 words in the seven hours during which report is sent for the morning papers. This speed was gradually causing many old-timers to quit the key and give up to more ambitious youths.

With a typewriter, however, a speed of from 45 to 50 words per minute is mere fun for an expert telegrapher, as he leans back in his chair catching the Morse characters as they fly over the wire, transforming them into English and then picking out the different letters upon a typewriter causing to appear in type here, news which that very second left New York.

The first telegrapher who ever conceived, or at least took courage to attempt the copying of press reports on a typewriter, was Charles Lantry, while taking reports at Elmira, N. Y., about 10 years ago. It was looked upon at that time as something remarkable. The first press report ever copied in this form in Rochester was done by Scott Farley, of the *Union and Advertiser*, about one year ago. Recently, however, William Pettingill, of the *Morning Herald*, and George F. Allman, of the *Democrat and Chronicle*, have mastered the art, and all three of these gentlemen are excellent typo-telegraphers.

About five years ago, before the adoption of the private wire system by the papers of the city, telegraph reports were received in a somewhat abbreviated form, being filled out and punctuated in the newspaper office. At present, however, by means of the typewriter, the operator is able to deliver to the compositors a printed copy, punctuated and capitalized, which all goes to show the advancement being made in modern journalism.

How to Make Arc Light Circuits Safe.

At the recent Electric Light Convention, Mr. J. D. Lockwood remarked upon the importance of safe arc light circuits, and thought that with proper application of our present knowledge, accidents to human life would be comparatively rare. The first thing to look out for was "grounds," which with properly instructed employés were easily taken care of. The Rudd ground alarm was discussed and explained. Daily tests were the next best thing for locating grounds. In the experience of the speaker, grounds occurred most frequently while circuits were in operation. Methods of testing and dividing and subdividing circuits until the ground was located were treated in full.

Mr. Law's system of locating grounds on live circuits came next, and its failings in the opinion of the speaker were unfolded.

"Now, we should at least be able to test up to 100,000 ohms, and as with a voltage of 3,000, we could only get a current through this high resistance equal to 3,000 divided by 100,000, we could thus only get $\frac{1}{100}$ of one ampere, and we should consequently use a system that could be operated by this amount of current. Now, to make our ground the least factor in the test, and as we would have only about one-half our incandescent lamps or high resistance coils in circuit in most tests, we must use resistance coils and make them of such a resistance that 30 will equal at least one megohm, and thus each one would be about 33,000 ohms. As this high resistance is necessary to apply this system satisfactorily, you can all see plainly why I do not approve of the incandescent lamp system. If, however, incandescent lamps are used for ground testings, only those of the highest possible resistance and that use the smallest fraction of an ampere are suitable; and of all the styles now on the market the eight candle-power 110-volt lamp is the most suitable, because if as many of these lamps are used as there are arc lamps in circuit they will each only get about 50 volts, and consequently about $\frac{1}{100}$ of one ampere, and will thus enable us to test up to a certain resistance equal to the maximum voltage of our circuit, say 3,000 volts divided by the amperage $\frac{1}{100}$ of an ampere, which would be 30,000 ohms, a great increase in range from the low resistance lamps, which only enabled us to test up to 2,400 ohms. If lamps are used we should also use a dead-beat voltmeter, such as is made by the Weston Electrical Instrument Company, and it should be connected in shunt around the first lamp of the series, which should be of enough higher resistance than the rest of the series to make it a resistance when connected in multiple with the voltmeter, just equal to that of each of the other lamps of the series. We could then when making our tests cut out of circuit the incandescent lamps until the voltmeter indicated as nearly as possible the voltage which our arc lamps average. The number of incandescent lamps still remaining in circuit would then correspond to the number of arc lamps between the end of the circuit being tested from and the ground. I would much prefer thus using a voltmeter and high resistance lamps to using low resistance lamps and bringing them up to normal candle-power. This outfit could also be used to find the average voltage of arc lamps on any circuit; and, having once determined this point, and also how many lamps the line is equal to, and then test and find out at any moment how many lamps are used on any circuit, and if we are running a number of circuits from one dynamo, we could thus find how many lamps are burning on each circuit, and plan our changes and combinations understandingly.

"A great improvement on this system would be a voltmeter to read up to 5,000 or 6,000 volts, such as Mr. Law says can be made by the Weston Electrical Instrument Company, and the amount of improvement would depend entirely upon the fraction of an ampere used to operate this instrument; the smaller the fraction, the greater the improvement. With such an instrument the coming on suddenly of a ground when a test is being made, even if at the opposite extreme of the circuit, would do no harm to the instrument. This instrument should be as nearly as possible dead-beat, so that in testing for a swinging ground the instrument would indicate accurately the voltage at the ground, even if the connection only existed for a moment. We now come to a system of testing, which I think a great improvement over those already mentioned, except in one particular, viz., the testing for swinging grounds. For this purpose the extremely high resistance and high capacity dead-beat voltmeter I consider better than anything else. This new system I had the fond belief, until a few days ago, to be original with myself; but I find the old saying that 'there is nothing new under the sun' has been again exemplified, by my finding that practically the same system is in use at the stations of the Arc Light and Power Company, in Chicago, it having been put in, I understand, by Professor Rudd, of the Western Electric Company, of that city.

"The system, in brief, is similar to the Wheatstone bridge, as the principle is to form a shunt circuit between the terminals of the arc circuit, by means of from 60 to 100 coils of high resistance, connected in series, and then by means of any very high resistance galvanometer, finding the point on the shunt circuit, from which no current will flow to grounds; then, by noting at what point on the shunt or testing circuit this neutral point is, the ground for it can be easily located. In applying this system, I would provide means for cutting out of circuit any number of these coils, with the idea of using at each test only as many coils as there are arc lamps burning on the circuit at the time of the test; then when the neutral point is found, you can see at once, without any figuring, between what lamps on your circuit the ground exists. The advantages of this system are: First, it creates no new dangers. Second, the question of how high a resistance ground can be tested, depends simply upon the sensitiveness of the galvanometer. Third, it is quick and accurate, and cannot be damaged by grounds suddenly coming on when testing.

"Now, as a necessary adjunct to any of these systems of testing, there should be prepared a list of the lights and service on each circuit, arranged in the order in which they are connected in the circuit, and stating which is the positive and which the negative end of the circuit. With such lists a competent lineman, when notified that there is a ground so many lamps distant from the negative or positive end, as it may be, of a certain circuit, should have no difficulty in quickly locating the same, and, to enable him to safely and quickly do this, he should be provided with a high reading voltmeter, so that by going directly to the point where he thinks the ground exists, and testing from the circuit to the ground with his voltmeter, he could tell whether the ground was very near or not, and if not, about how many lamps were between this point and the ground. Then, by testing again a little farther on, he would immediately see whether he was approaching or leaving the ground, and thus could quickly locate the same.

"In conclusion, I would say that I firmly believe that, if with such a system of testing as last mentioned, and equipping our circuits with good lightning arresters, and some such device as the circuit openers lately brought out to disconnect the dynamo from the circuit when the current ceases for an instant, through the breakage of a wire or any other cause, and then see that our employés use these appliances and do their utmost to keep all lines clear of grounds, we will have few accidents, and the press will have little or nothing more to say about the dangers of electricity."

The paper was well received, and an interesting discussion followed.

Search-Light Experiments.

Crowds have gathered during the week in the Battery Park and on roofs of down-town houses, to watch and wonder at the strange and brilliant light which from some place on Staten Island shot upward to an altitude of 1,500 feet. The sight was inexplicable to most of the spectators. It was a comet-shaped light, with the tail reaching to the clouds. Here is the explanation of the phenomena:

A series of interesting experiments in electricity were being conducted under the direction Mr. Dwight Wiman, general manager of the Richmond County Light, Heat and Power Company, at his laboratory, near St. George, S. I. Mr. Wiman is an accomplished electrician. He is the oldest son of Erastus Wiman. The object of these experiments is the perfection of a method for throwing powerful beams of light upward through thick smoke and heavy sea fogs. The marvelous capacity of the electric light when properly concentrated, has been recognized for some time, but Mr. Wiman is perfecting the apparatus so that it may be of still further advantage to mariners. A mortar-shaped reflector of large size attached to an arc light of 3,000 candle-power, has been used in these experiments. It is expected to illuminate clouds one-third of a mile above the earth; that is to say, above and beyond the region of the fog strata. The success achieved in the three trials made, two of them under adverse conditions, has been exceedingly gratifying to the electrician in charge. It is the intention of the Staten Island and New York Ferryboat Company to connect two of these mammoth reflectors to the "Erastus Wiman" and the "Robert Garrett," the new boats of that line. It will probably be done during this week.

Line Insulation from the Standpoint of Practical Experience.

BY CHARLES A. HARBER, AT THE KANSAS CITY ELECTRIC LIGHT CONVENTION.

The question of the day, for electrical industries, is insulation. Believing that any information bearing thereon, and derived from experience, may be valuable, I present a brief record of measurements to determine the relative resistance of several forms of insulation.

In what follows, I lay before you the results of daily measurements, made in the interests of the company whose stations I have in charge; but I assume to draw no conclusions, save the urgent need of constant vigilance. It being my object to draw out, rather than exhaust discussion, I leave to others the matters of proper construction, inspection, etc., all of which are equally important.

During the past 24 months, I have personally tested the insulation of our circuits. The instrument used is the Electrical Supply Company's standard testing set, composed of a silver battery of 24 cells, and combination of Wheatstone's bridge, with galvanometer and variable resistance. I have measures from $\frac{1}{100}$ to 1,111,000 ohms. Measurements are taken shortly before closing circuits, first taking the precaution, however, to ascertain if the circuits to be tested are crossed by live wires, which, if not producing sufficient current to endanger the instrument, might give an incorrect reading.

These measurements are then averaged daily, and also for the month.

It should be borne in mind that the measurements are limited to the capacity of the instrument used. This, however, is a matter of minor importance, as the value of insulation in practical work depends not on its highest, but on its lowest resistance.

Among our circuits operating Thomson-Houston arc lamps (about 10 amperes, at 50 volts) we have four, covered, respectively, by P. & B., Simplex, Grimshaw and Okonite.

The external conditions of those circuits are nearly the same. The Okonite circuit, in use 18 months, is 2½ miles long and operates 50 lamps; the P. & B. circuit, in use 15 months, is 2½ miles long and operates 40 lamps; the Grimshaw circuit, in use 18 months, is 2 $\frac{1}{10}$ miles long, and on it are 24 lamps; the Simplex circuit, in use 13 months, is 3 $\frac{1}{10}$ miles longs, and operates 40 lamps.

During the 12 months ending January 1, 1890, measurements of insulation of these circuits have averaged:

P. & B., 485,702 ohms.
Grimshaw, 891,392 "
Simplex, 895,122 "
Okonite, 900,212 "

The average lowest resistance for the 12 months is as follows:

P. & B., 35,200 ohms.
Grimshaw, 160,400 "
Simplex, 163,871 "
Okonite, 172,913 "

Loss of service during the year directly attributable to grounds is, on the P. & B., 301 lamp hours; Grimshaw, Simplex and Okonite, none.

Dynamos Driven by Gas.

A highly interesting fact has been brought out by Mr. O. Tirrill, of 39 Dey street, New York, in some practical tests in producing electric light by using illuminating gas for driving a gas engine and a Perret dynamo. Naturally one would suppose that the loss due to the double transformation of energy in producing the electric light from illuminating gas by this means would place the cost of the electric light far above that of gas. On the contrary, however, Mr. Tirrill has found to his surprise that a given amount of gas will produce far greater illuminating effects when used to drive this dynamo than when burned direct. The gasolene gas is produced by his machine for one dollar per thousand feet. The engine, it is found, consumes four feet of this gas per 16 candle-power lamp per hour when driving the dynamo under full load, making the cost per lamp two-fifths of a cent. per hour, so that the luxury of the electric light by this means, instead of being expensive, he finds in reality to be a great economy. Mr. Tirrill explains the phenomenon by the fact that his gasolene gas contains 80 per cent. of air when delivered at the explosion chamber of the engine, and he gets the benefit of the expansion of this large volume of air by the heat of the explosion.

* * Duluth is to have a motor line among her improvements for 1890. A corporation with a capital of $600,000 has already been formed for the purpose of constructing the road.

A New Lightning Arrester.

Mr. Henry W. Pope, of Elizabeth, N. J., is the sole agent of a new lightning protector, illustrated on this page. This protector is said to have never failed yet in a trial extending over a year's time. The illustration shows a swinging metallic ball, suspended above and as close as possible to a ground

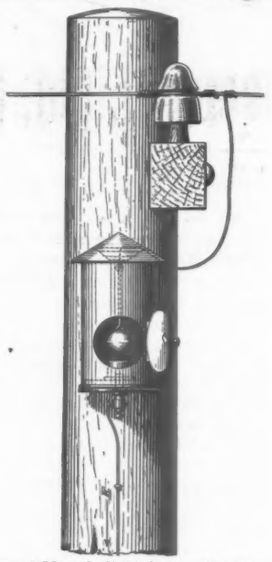


plate or table—the lightning passing to earth, jumping from the ball to the plate, causes the ball to swing and thus prevents the fusing of the metal, or injury, in any way, to the protector, and makes a permanent ground an impossibility. The "Razzle Dazzle," as it is called, is so simple, cheap, and effective, that it can be used liberally on the poles of telegraph, telephone, electric light, electric railways, etc., and by a neat attachment can be made to answer for any number of wires.

—— Now that citizens of Lawrenceburg, Ind., are hustling for electric light, the gas company has reduced its rate to $2 per 1,000 feet.

—— The Binghamton Gas and Electric Company, of Binghamton, N. Y., has increased its electric lighting plant by the addition of Westinghouse alternating current apparatus of 750 lights capacity. The Binghamton station will now have a total capacity of 3,000 lights.

—— At the annual meeting of the stockholders of the Cincinnati Electric Light Company last week, the following gentlemen were elected as directors for the ensuing year: A. Hickenlooper, R. Allison, Wm. A. Goodman, A. J. Kenan, E. V. Brookfield, C. H. Law and Sam. J. Broadwell.

—— The old method of furnishing electric light to consumers on the contract system is rapidly becoming a thing of the past, to be superseded by the meter system, which strongly appeals to the consumer by its features of equity and economy. One of the companies who have most recently adopted the meter is the Sing Sing Electric Lighting Company, Sing Sing, N. Y., which announces that it is prepared to furnish its customers the Shallenberger alternating current meter.

—— Dr. Charles W. Drew, the State chemist of Iowa, and Edward B. Francis, have recently been engaged in an extended series of experiments having for their object the advancement of the art of heating by electricity. The results have been exceedingly satisfactory, and several distinct forms of heating appliances have been devised, upon which letters patent have been asked. The inventions have reference to the employment of electricity as a source of heat in the household and in cookery, and also in the heating of railway and horse cars as well. It is the intention of the inventors to give in the near future an exhibition of their several inventions, in order that those interested in the matter may convince themselves of their novelty, practicability and successful working.

Stanley's Arc Light Alternating Current Dynamo.

Owing to the increasing demand for incandescent lighting, the attention of electrical inventors has of late been concentrated upon the construction of dynamos furnishing current at constant potential.

The solution of many problems of electrical distribution, however, requires a circuit of great length, throughout which it would not be possible to maintain a constant difference of potential, except by the expenditure of prohibitory sums, and which would not even then be adapted to the service required. For the purpose of avoiding this large expenditure for conductors, etc., it is customary now to force a constant current

Fig 1

through such circuits by means of potentials varying with the amount of resistance in the circuit and with the work to be accomplished at different times.

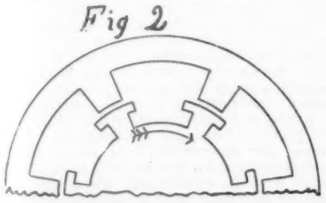
Heretofore dynamos constructed to supply such circuits have been made to furnish constant currents by means of the governing action of automatic regulators of one kind or another.

Mr. Stanley has invented a method of dynamo construction by means of which a current is generated and kept at almost absolutely constant value, without the employment of any regulating or governing devices, while the resistance in the circuit may vary with great rapidity and between wide limits. The speed of the armature may also vary indefinitely, without changing the strength of the current, provided this speed does not fall below a certain critical value. These dynamos will, therefore, furnish a given amount (as for instance ten amperes) of current to a circuit, which offers a high resistance requiring several thousand volts to deliver the current, and in an instant they may be short circuited, while at the same time the speed may vary above a minimum critical speed in any fashion imaginable.

These remarkable results are obtained by controlling the flow of the lines of force of the field through the armature by the lag of the armature current as follows:

Referring to the diagram, Fig. 2 shows

Fig 2



the position of the armature when the armature coil lies opposite the field pole. If there be but a single turn of wire on the armature it receives in this position the full field magnetism (all the field lines passing through the coil). If the armature be now turned in the direction of the arrow, an E. M. F. will be generated in the coil by the reduction of the number of field lines threading it, and a current flowing in it will arrive at its maximum strength when the coil has reached the position shown in Fig. 1. The diagrams Figs. 1 and 2 fairly represent the positions of maximum and zero current, when the current in the armature produces a small magnetization of the armature core, and the self-induction of the coil is neglected.

Suppose, however, that a great number of turns of wire are wound upon the armature, and also that they are so closed about by the armature core as to offer a high self-inductive resistance to current flow. Then (assuming the self-induction to be a maximum) the current in the armature will be delayed in its flow through 90 degrees of phase, so

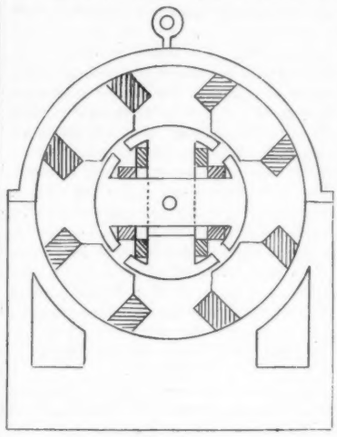


FIG. 4.

that the current will arrive at its maximum when in the position shown in Fig. 2.

Mr. Stanley winds his armatures for constant current service with a large number of turns, producing a strong magnetization of the armature, and employs upwards of 4,000 alternations per minute.

The consequence of this is that, when the machine is short-circuited, the lag becomes nearly 90 degrees and the current reaches its maximum value when the armature is in the position shown in Fig. 2. Thus an armature pole is produced opposite the field pole and nearly equal to it in strength, and the field lines are driven outside of the coil instead of passing through it, and consequently the dynamo delivers only such an E. M. F. as will drive the normal current through the armature resistance.

If now a resistance is put into the circuit, the armature current falls slightly, reducing the lag and also the opposing magnetic effect of the armature coil, because, when the field and armature poles are opposite each other, the armature current is not at its maximum and the ampere turns of the armature are less than before, and, therefore, more of the lines of force of the field are allowed to thread the armature coil and the E. M. F. is increased.

We conclude then that increasing the resistance in the circuit reduces the lag. Reduction in the lag reduces the opposition offered by the armature magnetization to that of the field, thereby allowing more lines of force to thread the coil and thus increasing the E. M. F. generated.

In practice these dynamos have been built for currents of 3,500 volts and 9.6 amperes and of 2,000 volts and 30 amperes, and while delivering these E. M. F.'s they may be instantly short-circuited without even causing a strain upon the belt driving the machine and with hardly a jump of the ammeter.

From the above it will be seen that the E. M. F. of the dynamo varies inversely as the lag of the armature current, as a consequence any variation of the lag will also vary the E. M. F. If then the number of alternations be increased by increasing the number of revolutions of the armature, the lag of the armature current will increase, and the increase in E. M. F. due to the increased speed will be balanced by the reduction of E. M. F. due to increase in the lag, and the current delivered will thus remain of constant value.

A moment's reflection will show that the E. M. F. of each wave of current delivered by the dynamo is governed independently of all the others, and that the time required for any regulation is less than the time of 90 degrees of current phase; presuming that the dynamo delivers 7,500 waves of current per minute, or 125 waves of 180 degrees of phase per second, the entire time required to govern it will never exceed $\frac{1}{125} \div 2$, or $\frac{1}{250}$ second.

Of course, these dynamos may be constructed for either direct or alternating current machines.

Fig. 3 shows the characteristic of the machine and the relation of current to speed.

Fig. 4 is a view of the dynamo, showing method of surrounding the armature coils with iron so as to obtain a large self-induction.

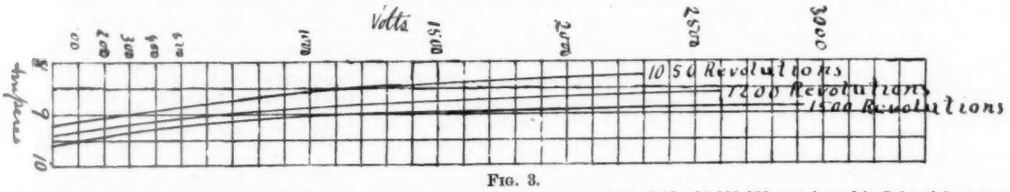


FIG. 3.

The Growth of the Thomson-Houston Electric Company.

The *News Bureau*, of Boston, gives the following interesting account of the business of the Thomson-Houston Electric Company:

Thomson-Houston Electric Company will, before long, present its stockholders with a complete annual report of operations for the year 1889. In view of the rapid growth of this company, and the phenomenal development in the electric field the last few years, this report will be studied with much interest by the investing public, as well as by the stockholders.

The Thomson-Houston Company earned net last year above $2,000,000, $1,000,000 of which it paid to its stockholders and over $1,000,000 it carried to surplus. The company at present is earning about $15 per share upon its common stock, or at the rate of 60 per cent., the par value of the shares now selling at $51, being $25. The authorized common capital of the company is $10,000,000, of which $4,500,000 have been issued, and $5,500,000 are still in the treasury of the company. The authorized amount of the preferred stock is $5,000,000, of which $1,000,000 was issued in July of last year. Recently $3,000,000 were placed at the disposal of the directors by vote of the stockholders. A portion of this stock has just been offered to the stockholders at $25.25 (par $25). While it was not expected that subscriptions for more than $1,000,000 would be received, at the time the subscription closed they were considerably in excess of $1,500,000. The proceeds of the remaining $1,500,000 will not be required until later in the year. Negotiations for placing this at a considerably higher price are in progress.

The annual business of the Thomson-Houston Company is now in excess of $10,000,000. The net income per month amounts to $250,000, besides which there accumulates about $50,000 per month of undivided profits from this company's ownership in other companies.

The company employs 2,500 hands at its factory in Lynn and a force of 150 at its Boston office. The Lynn pay-roll amounts to $27,000 per week.

The amount still due on account of the purchase of the Brush interest is $1,300,000, maturing in monthly payments, the last installment of which is not payable until January, 1891. The issue of preferred stock will easily provide for this.

Detroit, Mich.—The Detroit Electrical Manufacturing Company has been incorporated with a capital of $350,000, of which $35,000 is paid in. The stockholders are: William C. Bennett, president, 5,000 shares; Nelson K. Riddle, vice-president, 5,000 shares; William L. Wild, secretary, 5,000 shares; and Thomas Harris, Alfred Woodward and Henry F. De B. Cameron.

San Francisco, Cal.—The Underground Construction Company has incorporated, to manufacture and lay telegraph and telephone conduits or pipes in this city, with a capital stock of $1,000,000, of which $250 has been subscribed. The directors are: F. C. Carlsen, E. F. Badgley, W. B. Reynolds, P. Humphrey and C. M. Oakley. They also propose to carry on and conduct general electric light work.

Racine, Wis.—The Fond du Lac Electric Company, of Racine; capital, $50,000; incorporators, John Rodgers, F. M. Fish and J. E. Dodge.

Superior, Wis.—The Telegram Printing Company, of Superior; capital, $25,000; incorporators, J. T. Murphy, William B. Banks and B. S. Loney.

Bristol, R. I.—The King Philip Electric Company is the name of a new concern, formed for the purpose of manufacturing a dry battery, the invention of Mr. P. C. Howe, of Boston.

Chicago, Ill.—United States Cold Wire Rolling Company, at Chicago; for the cold rolling of metals into wire; capital stock, $500,000; incorporators, H. B. Bryan, Frank Weeks and Franklin Hathaway.

Chicago, Ill.—Marquette Electric Construction Company; location, Chicago; to operate electric machinery for the purpose of furnishing light, heat and power; capital stock, $25,000; incorporators, Alfred L. Baker, Samuel S. Parks and Eben F. Runyan, Jr.

Scottdale, Pa.—The State Department at Harrisburg issued the following charters: Scottdale Electric Light, Heat and Power Company, of Westmoreland county; capital, $15,000. The Mill and Mine Electric Equipment Company, of Pittsburgh; capital, $10,000.

Bucksport, Me.—The Bucksport Electric Company has been organized at Bucksport, Me., with the following officers: President, John Post, Jr.; vice-president and general manager, F. T. Palmer; treasurer, Otis K. Smart. The company intends to erect a 1,000-light incandescent plant.

Corvallis, Ore.—The Corvallis Electric Light and Power Company, with principal place of business, Corvallis, Ore; capital stock, $20,000, divided into 200 shares of $100 each; incorporators, L. L. Hurb, J. W. Porter, W. C. Corbette, G. E. Lilly, Zephin Job; purpose, to carry on at Corvallis an electric plant or plants.

Newark, N. J.—Articles of incorporation were filed in the county clerk's office by the Delta Engineering and Manufacturing Company, for the manufacture of machinery. The capital stock is $50,000, and the company, will start business with $3,000. The incorporators are John L. Seward, of Orange, and Joseph H. Scharff and Francis S. Scharff, of Newark.

Ellensburg, Wash.—W. E. Anderson and associates have been granted a franchise for either cable or electric lines of street railway on several leading streets of the city. They filed a bond of $10,000 to begin work within 30 days and to have at least three-quarters of a mile finished in four months on penalty of forfeiture of the bond. The franchise was granted for 50 years.

Indianapolis, Ind.—The Edwards Railroad Electric Light Company has been incorporated at Indianapolis, Ind., by Edgar H. Edwards, Chas. G. Jenner, Charles L. Doughty, W. N. Gray and Walter Cox. Its object is to manufacture and repair all kinds of electric light machinery and locomotive head-lights. The capital stock of the new company is $1,500,000.

Portland, Me.—The certificate of incorporation of the Guest Alarm and Signal Company has been filed. Its object is to carry on the business of manufacturing alarm, signaling and electric lighting appliances. Its capital stock is $500,000. The officers are: President, Charles O. Welch, Cambridge, Mass.; treasurer, Russell C. Elliott, Somerville, Mass.; directors, George S. Smith, Cambridge, Chas. O. Welch, Russell C. Elliott.

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The best argument on the subject of a government telegraph so far made before the postal committee was made by Mr. Chandler, of the Postal Telegraph Company. It was candid, dignified and straight to the point, and, while strongly opposing the proposition of the Postmaster-General, gave that official credit for good intentions, and offered many valuable suggestions for putting his plan into the most practical shape.

An amusing incident comes from Hamilton, Canada. It appears that the location of the wires that were originally put into the basement walls of the city hall, connecting with the switchboard in the upper hall, has been lost, through somebody's carelessness during the building operations, and cannot now be found without ripping up the marble pavement and mutilating the walls in what might, after all, prove a fruitless search. We think this is the first occurrence of this kind ever recorded.

From figures presented to the legislative committee in Boston, it would seem that there is an imperative demand for an elevated railroad in the crowded portions of the city. President Whitney has the right idea in wanting to run this elevated road by electricity.

The fast telegraph tournament, which is to be held in this city April 10th next, promises to be an unusually interesting and important event. The REVIEW hopes that the best man—and he may be a lady—may carry off the honors, and to that end let all telegraph operators strive.

We publish in full the address of Mr. Grosvenor P. Lowrey, on "Patent Law," delivered recently before the Electric Club of this city. Every reader of the REVIEW will find this address brim full of information and instruction, presented most entertainingly. We would advise every one to read it.

Here is some timely and very sensible advice from the Denver *News:* "The city council should refrain from juggling with the lighting contract, If a fair offer, in accordance with their own suggestions, has been made and received, well and good, let the matter be settled on that basis. If not, proceed in a business-like way to get an offer that suits. A franchise is not a plant, nor a promise a performance. The public needs the lights—the council can indulge its propensity for franchises in some other direction."

The famous Pan Electric suit has been engaging the attention of the Washington Equity Court for the last two weeks and is likely to go on for some time longer. A most extraordinary gathering of eminent lawyers, statesmen, diplomats and soldiers, are arrayed against Rogers, and he seems to be able to keep them all interested. Ex-Attorney-General Garland is making no defense in the suit, but is simply leaving the whole matter to the judgment of the Court. Judges Hagner, Cox and James, are on the bench and their opinion will, doubtless, add some interesting reading to the great mass of Pan Electric literature.

President Green, on his recent visit to Washington, annihilated, not only the government telegraph scheme, but the Postmaster-General and the House postal committee with it. He severely criticised Mr. Wanamaker for attempting, as he charged, to "*coach*" the committee in regard to their duty concerning a measure which he had brought forward without the sanction of the President. He said to the committee, "the Postmaster-General, after having deliberately made an order which amounted to a confiscation of the property of the Western Union Company, comes before you and smilingly says he is on good terms with the telegraph companies. No doubt he congratulates himself that he can smile and smile, and murder while he smiles."

In New York City, the rapid transit problem, like the poor, we have always with us. A statistician has recently reported that the annual increase in the traveling public in this city amounts to 20,000,000. These figures are astonishing, but when it is taken into consideration that the elevated railroads alone carry between 500,000 and 600,000 passengers daily, the marvelous increase is not so much to be wondered at.

The crowded condition of all the means of cheap public conveyance in New York, amply attests the fact that the rapid transit question is not yet satisfactorily settled. Many schemes are on foot to remedy this deficiency in conveniences, and our lawmakers are lending us their assistance. Numerous and varied are the plans proposed, some bearing evidence "for the public good" stamped upon them, and others shadowed with a tinge the color of "private greed."

Whatever method of quick transportation is adopted, we venture to state that electricity will play its part in it and undoubtedly it will be a "star engagement."

GAS COMPANIES SHOULD GET IMPROVED PIPES.

It is said that the presence of gas in the New York subways is due to leakage from the gas mains. The penetrating qualities of coal gas are well known, a loss of 30 per cent. through leakage being generally admitted. The fact has been duly recognized that the iron pipes now in use are very imperfect conveyers of the insinuating fluid, but no material damage has resulted until it was suggested to put the electric wires underground. The manholes form receptacles for the gas, which a lighted cigar may suffice to explode. The electric companies have gone to considerable expense to keep the subways ventilated, and have succeeded very well. It is now time for the gas companies to secure a better means of transmitting their illuminant. Let them offer a prize to inventors for an improved material which will be impervious to gas. They will, if able to secure such a material, help themselves to a saving of 30 per cent. on their output and do away with the one solitary danger to be apprehended from the subways.

THE QUESTION OF SUBWAY DAMAGES.

A decision just made by the Supreme Court, of the District of Columbia, is of much interest to subway contractors. The court affirmed a verdict awarding $2,500 to a person who was injured by falling into a trench excavated by the heat and power company under authority from the District Commissioners. In decisions heretofore rendered in many similar cases, it has been held that municipal authorities were not responsible for such accidents, unless they had received notice that the danger existed; but in this case the court declared that no notice is required. The authorities must not only anticipate such dangers, but they must see that excavations are securely protected, and that the protection is maintained so long as necessary. It would not relieve them of any responsibility, even though the guards placed around excavations were removed by mischievous persons. Judge James, in announcing the decision, declared that "a city government cannot say we put up a good guard, and then go home and go to bed." In this Washington suit the heat and power company is the real defendant, and will have to pay the amount of the damages.

OBITUARY.

DEATH OF HON. CHAS. L. MITCHELL.

Charles L. Mitchell, of the Mitchell-Vance Company, died last Saturday at his house in this city. Mr. Mitchell was a member of Congress from Connecticut from 1883 to 1886. Since then he has been living almost constantly in New York. He was a member of the Electric, New York and Manhattan Clubs. He leaves a widow and one son. The interment will be at New Haven. Mr. Mitchell possessed many friends, was highly esteemed by all who knew him, and will be greatly missed in this city and throughout Connecticut.

DEATH OF EX-GOVERNOR ENGLISH.

Ex-Governor English, of Connecticut, died at his residence in New Haven, on Sunday last. The ex-Governor was a highly respected official, was said to be the richest man in Connecticut, and leaves a large family and scores of friends to mourn his loss. He was interested, with others of his name, in a number of electrical enterprises.

ELECTRIC METER SUIT.

A suit was on Tuesday of last week brought by the Edison Electric Light Company in the United States Circuit Court, Southern District of New York, against the United States Illuminating Company, controlled by the Westinghouse Electric Company, for infringement of patent No. 242,901, granted to Mr. Edison, June 14, 1881. It is claimed that this patent covers the only means of measuring and registering the alternating current, supplied to the customers of central stations throughout the country, and the action is significant of the determination of the Edison Company to sustain its patent rights in the field of incandescent lighting.

This meter, we are imformed, was perfected by Mr. Edison at the time of his application for this patent, March, 1881, and is known as the motor meter.

CORRESPONDENCE.

Electrical Happenings in Washington, Boston, Chicago and St. Louis.

OUR WASHINGTON LETTER.

There is a proposition before the House of Representatives for the appointment of a commission of three prominent government officials to investigate and test local automatic fire alarm apparatus, with a view of selecting some system to be placed in rooms in the public buildings in Washington, which are used for storage purposes, etc. Fifty thousand dollars is the estimated cost of the work considered necessary by the person who drew up the resolution, which has been referred to the House committee on public buildings. If it becomes a law the matter will have to pass the commission, and receive the approval of the secretary of any department to be protected before any contracts can be made.

The burning of Secretary Tracy's Washington house has led to inquiries concerning the dangers to which other official residences in that city are exposed, especially the White House. In the latter case it was found that the means of giving an alarm in case of a fire are very inadequate and, as no money can be expended for necessary apparatus without a special Act of Congress, which would be crowded out by rule-making and Worlds' Fair locating, the government has accepted a contribution of a few fire-signal boxes from a New York manufacturer, to be placed in the Executive Mansion.

The Government Telegraph scheme is in a state of chaos. The House Committee on Post Offices is sitting as a jury listening to the arguments of advocates before hearing testimony. The Postmaster-General appears to be striving to find out what the proposition he has submitted to Congress really means. And he is getting a good deal of light on that subject.

At the session of the House Committee, following that reported in the last REVIEW, Mr. W. A. A. Carsey, a bricklayer of New York City, representing the Knights of Labor, the Anti-Monopoly League and kindred organizations, made an earnest argument against the Wanamaker bill, basing his opposition on the fact that it proposed to have the telegraphing of the country done by contract and at very low rates. The labor organizations favor high prices, high wages and oppose all contract work. Mr. Carsey asserted that the great mass of laboring men in this country has little or no occasion to use the telegraph, and that the proposition to reduce the tolls and place the service within the reach of the working classes, is uncalled for. He favored the appointment of a special commission to regulate the business and prevent monopolistic injustice.

Mr. John W. Keogh, a New York shoe dealer, and a prominent member of the Anti-Monopoly League, argued in favor of Senator Spooner's bill placing the telegraphs under the control of the Interstate Commerce Commission.

On the 28th ultimo an important meeting of the committee was held, at which the Post Office Department was represented by General Wanamaker, General Tyner and D. H. Bates; the Western Union Telegraph Company by President Norvin Green, Superintendents Tinker and Marean, ex-Senator McDonald, Col. W. W. Dudley and Uriah H. Painter; and the Postal Telegraph Company by President A. B. Chandler. Mr. Gardiner G. Hubbard was also present.

The principal object of the meeting was to hear Mr. Green, who appeared by invitation of the committee. He made a deliberate, clear, forcible and telling argument against a government telegraph of any description, which had a sarcastic tinge of characteristic Western Unionism, that never admits that anybody outside of the company can know much about the business. He stated, that while every government in Europe, without exception, owns and operates its telegraph system, the business is done, uniformly, at a loss, and that the principal object of governmental control of the telegraph, is to protect the government from the people. In this country the people need to be protected from the government, which has no business to meddle with private enterprise. He contended that the government cannot do the business any cheaper or better than it is now done by his company, and that the people of the country are not asking for the increased facilities which the Postmaster-General wishes to give them. Out of 58,000,000 of people, not over 1,000,000 ever use the telegraph; and of all messages transmitted, 46 per cent. are sent by speculators. If the government desires to confer benefits on its citizens, let it cheapen railroad transportation, coal, woolen clothing, or some other commodity of universal use. Mr. Green strongly emphasized the statement that the present undertaking is an unjust scheme for making an entering wedge, which would destroy telegraph properties and compel their owners to sell at a sacrifice. If the government is to do a telegraph business, it should buy the existing lines, as it

has a right to do under the law of 1866, and, after getting them, it will need twice as many more to meet the demands of the people, who will insist on having connections with every post office in the land just as soon as the government is prepared to stand the loss which would follow the proposed reduction of 50 per cent. in rates.

The argument was supported by elaborate exhibits containing a mass of statistics and other valuable information relating to the details of the telegraph business in this and other countries.

Mr. Green was followed by Mr. Chandler, president of the Postal Telegraph Company, who presented a written statement. Mr. Chandler's conclusions in regard to the cost of telegraphic service, the injustice of competition by the government, etc., agreed, in the main, with Mr. Green. His argument, however, was more moderate, and dealt largely with the practical questions involved in the application of the Wanamaker scheme. It received the most careful attention and study of the Postmaster-General, who will undoubtedly find it useful in the development of his plan.

The Visual Synchronous telegraph system, invented by J. Harris Rogers, has been offered to the government as a means of performing the cheap telegraph service desired by the Postmaster-General, by James M. Varnum, of New York, counsel for the Visual Synchronism Company. The company claims that the Rogers instruments will transmit from 200 to 500 words per minute, and largely diminish the expert labor now required, and that under their system telegraphing can be done at a fair profit at the rates fixed by the Wanamaker bill.

Col. W. R. Plum, president of the Military Telegraph Society, is in Washington, and, in connection with Mr. Safford, is urging the passage of the bill in which the old army operators are so much interested. The matter is favorably progressing, and they have strong hopes of success during this session of Congress. Mr. Plum proposes to have a meeting of the society, in Washington, at an early day.

The petitions to Congress for a special investigation of electrical industries by the Census Bureau, to which reference was made in the last REVIEW, have not, so far, created a very favorable impression. The census schedules are being printed, supervisors are receiving their instructions, and the time for the work to be done is rapidly approaching. The enactment of a special law, granting the desired authority, and making the necessary appropriation, could hardly be secured in less than 30 days, if at all. Among the petitions received are some bearing the signatures of large numbers of persons whose residence, business and interest in the matter are unknown, and this fact renders the success of the scheme more uncertain.

The Volta Eclipse Electric Light and Power Company, of the District of Columbia, incorporated under West Virginia laws; $200,000, in $10 shares; Rev. Dr. John Chester, president; proposes to run small motors and light street cars, etc., by a primary battery, patented by Harris & Walsh. It is said that this battery is extensively used in England, where it is known as the D'Humy battery.

Electrical Matters coming before the Commissioners of the District of Columbia, are now placed in charge of Captain James L. Lusk, of the Army Engineer Corps, who gained a familiarity with the business during several years service in the office with Major Raymond. Col. Robert, the new commissioner, is gradually familiarizing himself with the details of the work, which ought to have the entire service of a good engineer.

The Telephone Bill in the Maryland legislature has been modified so as to allow a monthly rate of $4 in Baltimore and $3 elsewhere in the State. G. C. M.

Washington, D. C., March 1, 1890.

OUR BOSTON LETTER.

The Annual Report of Superintendent of Lamps George H. Allen, gives some interesting figures regarding the city lighting. During the past year, 798 electric lights gleamed along the spokes of the Hub, at a cost to the city of $180,895.96. The public lamps are burned every night in the year, a total of 3,828 hours.

New Electric Lines.—With all the new lines which the West End Company has under construction, the traveling public ought to be well cared for by May 1. A question which is agitating the public mind is, "Shall the electric cars go up Beacon street?" Whether they will or not remains to be seen.

South Framingham.—Articles of association are formed for the Natick Electric Street Railway Company, to build and operate a road through Natick, with one terminus at South Framingham and the other at Wellesley, with a probable extension to South Natick and beyond. The road, if built, will be operated by the electric lighting plants at South Framingham and Natick, and it is the general understanding that the Thomson-Houston Company is behind the move. Superintendent H. W. True, of the South Framingham and Natick Electric Companies, being the organizer. The plan is ultimately to have the road connect with the Newton line and thus secure direct communication with Boston.

Quincy, Mass.—The Quincy Electric Light Company has introduced a new circuit breaker into its plant at South Quincy, and a decided improvement in the operation of the electric cars is said to be the result.

The Boston Common Council has passed an order that a special committee, consisting of the president and four other councilmen, be appointed to consider the expediency of the city establishing gas and electric light plants.

The Marr Construction Company is erecting the poles for the Blue Hill Electric Light Company, of Canton. Good headway is being made, and with good weather the poles will all be put up in seven weeks.

The Edison Illuminating Company, of Boston, proposes to lay all their electric wires now overhead, underground. The company will soon add two stories to its Head Place station, for increasing the power plant of the company. The entire first floor, which is now used for dynamo rooms and offices, will be used entirely for dynamos; and the offices will be on the second floor. The third floor will be used for stock rooms.

The executive offices of the Thomson-Houston Electric Company will be moved in the course of a few weeks, from their present quarters on the second floor of the Hathaway Building, to the second and third floors of the New England Building, on Summer street extension, which is about completed. The Thomson-Houston Motor Company, which is now on the first floor of the Hathaway Building, will move up-stairs into the rooms that will be vacated by the railway department. The book-keeping departments will be enlarged.

The Thomson-Houston Company are building an electric locomotive for use in this city. It is similar in design to an ordinary street car, but only about half the size. It will be fitted with two motors and will be able to haul three loaded cars.

At the State House.—There is a bill before the Senate asking for legislation on the subject of the consolidation of gas and electric companies. The date for a hearing has not been fixed.

It is expected that a bitter competition will arise between the new Back Bay Electric Company and the Edison Company, over the lighting of the Back Bay district. The Edison Company has already applied for locations for their poles.

Mr. P. H. Alexander, Captain Brophy, Captain Flanders and others, stopped off at Pittsburgh on their way home from the Kansas City Convention, to visit the Westinghouse Factory and inspect the city fire alarm system. S. L. C.

Boston, March 1, 1890.

OUR CHICAGO LETTER.

Fire Destroyed the electric light station at Freeport, Ill., on Saturday last. The loss is between $20,000 and $25,000.

The Chicago and Suburban Belt Line Passenger Railroad and Extension Street Railway, was incorporated last week, with a capital stock of $2,500,000. The road is to be operated by cable or electricity. Incorporators: F. E. Barker, John A. Taylor, Edwin E. Harbert, F. L. Lotz, Sigmond Frankel, Louis Burnstein and Frank Gerrish.

The Western Department of the Payne Automatic Engine Company has removed to 26-28 West Randolph street.

A Lady, Claiming to have been held up one evening last week, says the highwaymen touched her on the arm with a shining metal instrument which caused her to drop to the sidewalk, at the same time releasing her hold on her pocketbook, also several packages. The lady is certain that electricity was used, as she has often used it and knows its effect.

The Following Gentlemen were registered at the Electric Club and guests of J. M. Dennison: N. R. Persinger, Central City, Neb.; W. A. Burns, Omaha, Neb.; W. H. Deniston, Pittsburgh, Pa.

Storage Battery.—On Wednesday a chair car arrived on Union Pacific R. R. equipped with a new storage battery, for which great efficiency is claimed with a great reduction in weight. The battery was made in Denver, Col.; 10 lights, eight in the body of the car and one in either end, in the vestibules were run 30 consecutive hours. Dr. W. A. Johnston, secretary and treasurer of the Denver Company, and T. G. Johnston accompanied the car on its trip.

Personal.—Mr. Daniel C. Hemingray, of the Hemingray Glass Company, of Cincinnati, Ohio, was a recent visitor in the city. —Mr. Wm. Hood, manager of the Western office of the New York Accumulator Company, returned to Chicago Thursday after a two weeks visit in the East.—H. D. Ames, of the Electrical Supply Company, Chicago, returned this week from a Western trip.—F. S. Seery, manager of the Electrical Supply Company, left for the East on Wednesday.

The National Electric Traction Company, of Detroit, Mich., made a test of their new motor for street cars, at Decatur, Ill., on Wednesday, the motor surpasses anything yet produced in that line by the above company. It is the invention of F. B. Rae. At the test the motor worked to the entire satisfaction of all present.

At the Next Regular Meeting of the Chicago Electric Club, which will be held on Monday evening, March 3rd, Dr. Paul Schoop of Zurich, Switzerland, will read a paper entitled "A Theory of Accumulators." The paper will undoubtedly be very interesting.

The Electrical Construction Company, Chicago, has closed contracts to wire Fuller's Opera House, Madison, Wis., for 700 incandescent lights, and the Julien Hotel, Dubuque, Iowa, 200 number return call and fire alarm annunciator. D. B. D.

March 1st, 1890.

OUR ST. LOUIS LETTER.

The Bell Telephone underground conduit bill came up for consideration before the public improvement committee. Mr. George F. Durant, manager of the Bell Company, stated that 18,000 wires would lead from their new station at Tenth and Olive streets; 160 ducts would lead from the building to the first street intersection, when they would branch out—north, south, east and west—60 of them going westward and the remaining 100 being distributed through the business part of the city. They will build the conduit without disturbance to water, gas and sewer pipes, and without cost to the city. The conduit at the main station will be three feet wide and six or eight feet deep, but will necessarily decrease as it proceeds out towards the city limits, so that when it reaches the thinly settled portion of the city, it will be only about one foot square.

The Lindell Railroad Company has contracted with J. G. Brill, of Philadelphia, for 200 cars, cushion seats, electric lights, etc., and have contracted with the Sprague Electric Railway and Motor Company, of New York, for electric motors and plant. They pay $75,000 for the cars and $100,000 for the motive power.

Contradictory Reports of the Broadway Line's change of power have been floating about. Whether they will change to cable or electricity is not certain, but it is probable they will have a combination of the two.

The Sixth Street Line will invest $400,000 in electricity. The Thomson-Houston system is to be used, contracts having been made with that company for the wires and plant, and 24 motors have been ordered.

The Bellefontaine Line has decided to change from horses to electricity. It has not been decided what system they will use, but they are soliciting bids. The road will be run by electricity as far as Twentieth street, and from there on horses will be used. This is done in accordance with the city's instructions, which refuse to allow the electric wires to be strung in the business portion.

There is Talk of the Jefferson Avenue and Northern Central Lines changing from horse to electric power. As it is now, the prospect seems good as regards the electric motor in this city. It is estimated that from $3,000,000 to $5,000,000 will be invested in it when the roads now changing have been completed.

Personal.—James J. Wood, inventor of the Wood electric arc lamp, and Henry C. Adams, of the New York office of the Fort Wayne Jenney Electric Company, were in town recently, in relation to the city's lighting.

Societies.—Prof. Francis E. Nipher, of the Washington University, addressed the Association of Alumni of the St. Louis Medical College, Wednesday night, February 19. His subject was: "Electric Lighting Circuits for Medical Use." He showed its advantage over the battery scheme, now in vogue, and demonstrated how, with the reduction of a 100 volt incandescent current, a much superior system, at a comparatively small expense could be had.

Suburban.—East St. Louis, Ill.: This city will, after March 1st be lighted entirely by the arc light, 60 of which are now ready for use. The city pays $125 per year for each lamp, which price is about the same as that paid for gas. The gas companies intend to fight the city as regards its lighting as they have a 15-year contract with it.

The Cable and Western Railroad Company has at last obtained a right of way to Forest Park. In return for this privilege, however, it must pay the city $1,000 a year and must provide electric lights along the line of the road to the satisfaction of the Board of Public Improvements. The wires for its western electric division will be carried on poles placed in the middle of the street, with T arms extending over the tracks to support the wires. The rate of speed is fixed at 10 miles an hour, east of Grand avenue, and 15 miles an hour west of Grand avenue.

The Lindell Railroad Company, in its attempt to get its bill passed, has repeatedly been defeated by its many objectors. It offers to pay the city $1,000 a year for the privilege of maintaining electric lights along its routes, if the city will grant it a franchise.

Electric City, Ill.: This is the name of a new railway station, situated near Venice, Ill. May it become as prominent as the power after which it is named.

St. Louis, Feb. 22, 1890. W. H. B.

PERSONAL.

Mr. H. D. Hall, a member of the Electric Club, died recently at his home in this city.

Mr. S. M. Bryan, the telephonist, of Washington, was a New York visitor last week.

Hon. Chas. S. Gleed, attorney of the Missouri and Kansas Telephone Company, is visiting the cities of Boston and New York.

Gen. O. E. Madden, president of the Electric Club, is enjoying a visit in London, hob-nobbing with ex-President Davis of the same Club.

Assemblyman Adams, supporting the bill allowing reporters to be present at electrical executions, claimed that death would have added horrors were the emissaries of the press present. The e. o. t. p. will probably "lay" for Statesman Adams.

Dr. Leonard Waldo, manager of the Aluminum Brass and Bronze Company, Bridgeport, Conn., paid a flying visit to the metropolis last week. Dr. Waldo takes an active interest in the Electric Club of this city, and is doing good work as chairman of the library committee.

Mr. Dexter Smith and Mr. Geo. Nye, two of the handsome men of Auburn, N. Y., were visitors in this city last week, the guests of Hon. Henry Laurens Storke, at the Electric Club. Mr. Smith was one of the early birds in the telephone business, and, as a result, captured the historic worm.

President Knapp and Secretary Burrage, of the Suburban Light and Power Company, of Boston, made a flying trip to New York last week, to inspect the new arc lamp of the Westinghouse Company. This lamp is run by an alternating current, by means of the converter systems. The carbons used are flat in form.

He Was Well Received by the Telephonists.

Monsieur S. Seligmann-Lui, of the French government, who was a recent visitor to this country, looking into electrical matters, particularly those relating to telephone work, writes the following letter to Mr. W. D. Sargent, president of the National Telephone Exchange Association:

On board S. S. "Bretagne,"
February 15, 1890.

Dear Mr. Sargent:

Excuse me, please, if I did not call upon you before my departure. I was very overcrowded with business during these last days. * * * *

I wanted to see you personally for your many kindnesses for which I desired to return thanks, and also in the person of the president of the association, to all the American telephone men. They received us not as foreigners, not as troublesome, indiscrete and time-taking inquirers, but as colleagues and friends, even as professional associates, to whom they did not decline to explain in the most complete way, the advantages or evils of any system.

By this frank and open behavior they made our task easier, and to all of them, not only in my name and that of my assistants, but nearly in an official way in the name of the French service, I wish to return them best and most hearty thanks, and should be obliged to you for telling it at the first opportunity.

As to yourself, dear sir, I felt much honored and gratified to be acquainted with you, and will keep of our visit in Brooklyn the most pleasant remembrance.

I am, dear sir, yours very truly,

G. SELIGMANN-LUI,
Inspecting Engineer to the French Government Telegraphs, 6 rue Daubigng, Paris.

The price paid by the purchasing syndicate for the Newark surface roads was $3,400,000, including the mortgage of $1,500,000. It is proposed by the buyers to equip the lines with overhead electric wires, if possible. The assertion that Whitney, Widener, Elkins and their associates had bought the road was erroneous. The syndicate represented by the bankers, Moore & Co. and Clark & Co., of Philadelphia, is a rival of the one which Messrs. Elkins and Whitney are identified with. The Essex Passenger Railroad Company has been making such large profits, it is stated that it has feared to make annual reports to the legislature as demanded by law, and nobody has insisted upon the reports being filed.

Telephone News

*** The city council of Minneapolis has granted the telephone company conduit rights for 20 years.

*** Efforts are being made to establish a telephone line from Tampa to Plant City, Lakeland and Bartow, Fla.

*** The St. Paul Telephone Company has filed a schedule of its gross earnings, etc., with the State auditor. The gross receipts for the year ending June 31, 1889, were $17,650. The law permits the company to pay royalties out of this sum, and the royalties amount to $4,942, leaving $12,708 taxable earnings, and the two per cent. tax amounts to $254.16.

*** The directors of the Erie Telephone and Telegraph Company have filed petitions for rebates in full for taxes assessed on them as stockholders in the Northwestern, Southwestern and Cleveland Telephone Companies. They held no stock in the companies referred to, May 1st or any date since. The assessment was made with a view of getting at who the stockholders are.

*** The telephone business of Lewiston and Auburn, Me., has grown to such an extent that the present arrangement of calling for individuals is about to be abandoned. The system of calling by numbers, in use in larger cities, will be substituted. The "multiple switchboard" by which this will be accomplished is in Manager Noyes' room at the exchange, but is waiting for an expert to put it in place.

*** There are some people who make queer disposals of their telephones. A well-known undertaker of this city, has his telephone on a dumb-waiter. He runs it up to his room at night and can answer it without getting up. In the daytime he runs it up out of sight after he has used it, and when the people who are always wanting to "use your telephone for a moment," drop in for that purpose he tells them they can use it if they can find it.

*** These directors of the Central New York Telephone Company were chosen last week at the annual meeting in Utica: Robert S. Williams, Lewis H. Lawrence, Charles A. Nicholson and Francis G. Wood, of Utica; David B. Parker, of Randolph; Martin A. Knapp and A. Caldwell Belden, of Syracuse. At a subsequent meeting, the directors elected R. S. Williams, president, Lewis H. Lawrence, vice-president, F. G. Wood, secretary and treasurer, and Charles A. Nicholson, general manager.

*** The New Jersey Telephone Company will continue its wires from Plainfield to Bound Brook, Finderene and other adjacent towns, whose residents have been clamoring for telephone service for years. The work of extending the line was progressing rapidly when a farmer who owns a wide tract of land through which the company wants a right of way refused to allow a post-hole to be dug on his land, unless the company paid him a bonus of $500. The matter will be carried into the courts.

*** The stockholders of the Colorado Telephone Company held their annual meeting at the company's office in the Tabor block, Denver, last week for the purpose of electing officers and a board of directors for the ensuing year. The old officers were re-elected and were: President, Henry R. Wolcott; vice-president, Charles L. McIntosh; secretary, C. R. Cundy; treasurer and general manager, E. B. Field. The board of directors consists of Henry R. Wolcott, Edward O. Wolcott, John E. Hudson, W. D. Graham, George Albree, Charles L. McIntosh, Phillip Feldhauser, J. L. Jerome and James V. Dexter. The annual statement of the company will be made soon to the directors.

Application of Electricity to Street Railways.

F. J. SPRAGUE.

The following is an abstract of Mr. Sprague's paper before the Kansas City Convention:

"Scarcely 15 years—a period of time yet within the memory of the youngest of us—have passed since the beginning of the new era, the transmission of energy for light, power and the reproduction of speech. Of the progress of the first I need not speak, for the delegates of this Convention are well cognizant of its history and the advance it has made within that time. The spread of the telephone to nearly every town and hamlet in the 14 years since it was exhibited as a scientific toy, at Philadelphia, and the financial success of the parent company, are facts continually before your minds or ringing in your ears. But that great industry, the transmission of electricity for power, with its possibilities of all kinds, is of very recent development. Six years ago there were scarcely a hundred electric motors in operation in the United States for any purpose; to-day there are no less than 15,000 motors in use, applied to not less than 200 different industries, and an industrial revolution is taking place equaling, if not surpassing, in importance that attending the introduction of the steam engine, and marvelous in the rapidity of its growth.

"It is not my purpose to dwell at length upon the subject of the transmission of power by electricity in its general application, but to touch upon one branch only, that of railway work, reviewing very briefly the development in the United States, pointing out the salient features of successful operation, noting what has been already accomplished, and after some remarks upon the legal questions which have arisen, considering the possibilities of the future.

"The modern electric railway may be said to have been born in Europe; its babyhood was in Europe, but in its youth and younger manhood it is purely American. In 1881, Dr. Siemens, of Berlin, established the pioneer railway on the Lichtenfelde line, in the suburbs of Berlin, and I believe it is still running. It was followed by other roads, some commercial and other for exhibition, erected by the firm of Siemens, and by work done by other electrical engineers. The Siemens also established a line at Frankfort. The Doctors Hopkinson established one at Portrush, Ireland. Another was established at Blackpool. This last was a conduit system. A double metallic overhead system was established in 1888 at Vevay, Switzerland, and comparatively recently the Siemens have established a conduit system at Buda Pesth.

"The first line which was established in the United States for actual commercial service was a suburban line of two miles in length, built by Mr. Daft, just outside of Baltimore, in the latter part of 1885, using a central rail. Other lines were established by Mr. Vanderpoele in various parts of the country, using the single and double trolley system, with the trolley traveling upon and carried by the wire and connected to the car by a flexible cable.

"In all this pioneer work the system used was that of direct supply, but most of the mechanical features, as well as the electrical details, have now given way to other and more efficient methods of operation.

"Of the more recent work, three classes demand attention, one being the system of independent units operated by the storage battery, and the other two being direct systems of supply, one underground, the other overhead. I shall not enter into details of these three systems, or their modifications, for it would be a repetition of much which has already been written, but I will briefly state the facts, and the conclusion I have formed concerning them.

"There is something exceedingly attractive in the proposed application of storage batteries to the propulsion of cars. To be able to conveniently store up a large amount of energy in a box, put it aboard a car, carry it around with us, and take from it a greater or less amount of work, offers, when practicable, a solution of the street car problem for which we are all devoutly hopeful. But look at it commercially. The storage battery is still a long ways from being a serious competitor of the direct source of supply. True, great improvements have been made in it, but these improvements have not very much altered its character, or the weight which is necessary, or the care which must be exercised in getting an economical return from the battery. These improvements have made it possible to take a heavier charge from the battery without producing buckling, have made a rougher usage of the battery mechanically possible, and have in some instances greatly reduced its cost of manufacture, so that the element of maintenance is a less serious one than it was a year or two ago; but the capacity of the battery, while it has been somewhat increased, remains such that it is still necessary to have about 3,500 pounds to propel an ordinary street car. This means an excessive weight. It takes up space, and is a serious extra load to be carried around. It requires frequent shifting, and its capacity as well as discharge rate are so limited, that it is simply impossible to work such a battery upon grades which are at all severe. I believe it is possible, with care, to operate a storage battery on grades not exceeding, say, four per cent., and with limited speed and daily mileage, at an expense about equal to that of horses, or a little less, but still at about double the expense which is necessary upon a suitably erected and properly operated overhead system.

"Nowhere in the United States, that I am aware of, is there serious storage battery work being done at the present moment. The nearest attempt was where recent experiments were made on the Madison Avenue Line, New York City, where about a dozen cars were being run up until eight o'clock in the evening, but owing to legal complications only two cars are now running there—with what daily mileage I do not know. But nowhere is the work done at all equivalent to what is constantly practiced on the overhead line. On that service motor cars start out at five or six o'clock in the morning, and run until midnight. Many cars make 150 or 160 miles a day, and some cars have even made 180 and 190 miles a day. Half of this for storage battery work is good duty, but it is not up to the demands which street railway managers make, and until the radical improvements which are promised are made in it, the field of application will be limited.

"The conduit system of direct supply has been attempted in several places, notably at Denver, Cleveland, Allegheny City and Boston, but at all the places mentioned these experiments have proved disastrous and have been abandoned, save the short section at Allegheny City. In England, the Blackpool line, under special conditions, has been, I believe, fairly successful, and at Buda Pesth, the Messrs. Siemen have a conduit system in successful operation. There, however, the drainage is very perfect, and in addition a man is detailed for given sections of the track, and is continually employed in patrolling his section and clearing it out. Assuming good sewerage, the conduit can unquestionably be made to work. It becomes then a question of cost; but for general application, especially in view of the fact that most of our cities do not have a sewerage system which can take care of the street drainage, the expense is prohibitory save on large systems under exceptional conditions. I look forward to the time when many existing well constructed and well drained cable conduits will become electrical conduits, and electricity will then score another victory.

"The system, however, which has made such a marked advance is the single trolley overhead system with universably flexible underneath contact, and this has been the growth of the past two and a half years. I think I can fairly claim for the Sprague Company the pioneer place in this development, but the commercial development on the lines it laid down has been with great energy pushed forward principally by both it and the Thomson-Houston Companies. The first work done by the Sprague Company, other than experimental work on the elevated railroads, was made but a short distance from this city. A single car was started in 1887 on the Union Passenger Railway Company's line in St. Joseph, with a small 7½ horse-power motor, single geared and adapted to run at a very high speed on a suburban extension. It is a matter of interest that that road has seen nearly every change made in the system. Its lines have been extended twice, and it has both the old style motors and the more modern equipments. But all the work done on that line was, it may be said, purely experimental, and it was not until the 2d of February that the Richmond road was officially opened to the public. I speak of this road, not so much because of my personal interest in it, but because it marked an era in the development of electric railways. A radical departure was made from the work which had been done prior to that time, not only in the amount and extent of the system equipped, and the number of machines operated, but also in the disposition and control of the machines, the system of overhead wiring, and the method of getting the current from the wire. The characteristics of that line are now pretty well known. It was a road of about 12 miles in length, with 30 curves, some of them of exceedingly short radius, with grades running as high as 10 per cent., and with a road-bed utterly unfit for the traffic which it had to support. The equipment was for 40 cars, requiring 80 machines, and was to be operated from one central station. When first proposed, the attempt was looked upon with a good deal of ridicule, not only by street railway men, but by electricians themselves. The street railway men thought that the ordinary condition of street car service would make it impossible for a self-propeller car to ascend a grade exceeding five or six per cent., and as for attempting a ten per cent. grade, that was out of the bounds of reason. As regards the electrical problems, the motors, instead of being placed on the car body, flexibly connected by chain gearing or belts to the axles, were placed underneath the car, and flexibly and concentrically geared to the axles. They were uncovered and exposed to the mud and moisture, and to all the accumulations which might collect in the street. They were built to run on a 400-volt grounded circuit, and to run in either direction with fixed brushes. Insanity was a mild term to designate the mental condition of one who made these proposals. The motor man was confined to his ordinary platform and the regulating devices there situated. A wire of one-fifth of an inch in diameter was extended over the track, and supplied at intervals of its length by a wire carried alongside the street where the strain upon the poles was least, and this main conductor was supplied at three or four central points by feeders from the central station. The current, moreover, was taken from this wire, not by a traveling carriage upon the wire, flexibly connected with the car, but by an arm reaching upward and pressing underneath the wire. This contact arm, which is now technically known as the trolley pole, was placed in the center of the car and had a universal movement, resisting up and down displacement sufficiently to make a good contact with the wire, but at the same time free to follow all vertical deflections. In addition, it had a lateral movement of considerable reach, offering little opposition to any side deflections by the wire itself.

"As illustrating the progress of electric railways, I may state that there are about 130 towns or cities in the United States with one or more electric railways in operation, construction or under contract, and that these roads comprise about 1,500 miles of track, equipped with 1,700 motor cars, requiring 3,000 motors, of an aggregate capacity of 45,000 horse-power, and steam and electrical generators of 25,000 horse-power. The roads in operation are making about 100,000 miles per day, and within three months the mileage will be doubled.

"As regards danger, the electric car is the safest possible vehicle, because of the remarkable facility of control, and as to the objections to the overhead line on the score of danger, which have been raised sometimes by the municipal authorities, and which have been cited by the telephone interests, they are, we may safely say, imaginary rather than real. Some two years and a half ago I settled upon 400 volts as a fairly satisfactory standard of potential for which the motor for street railway service should be built, allowing about 10 per cent. drop in the distribution on the line, making the potential in the station about 440 to 450 volts. In some cases, where dealing with heavy work on extended lines and small conductors, we have raised the potential at the motors to about 450 volts, making no change whatever in the machine, and have run the central station at 480 to 500 volts. There are in the United States about 80 electric railways in operation. Almost every employé of the contracting companies and a great many employés of the railway companies themselves, including not only the linemen, and those whose business it is to work upon the electrical equipment, but also the conductors and drivers, have received shocks from these lines of greater or less duration, and under almost every possible condition. Yet in no instance which ever came under my observation, or of which we have any reliable record, has serious injury resulted from the shock of the current itself. When we consider that these shocks have occurred to persons of all ages and of all physical conditions, and for varying periods, the experience seems to be quite ample to warrant the assertion that as ordinarily constructed a constant potential circuit of 500 volts is not dangerous to human life, and we can dismiss that question.

"Reviewing the work of the past two years, that which was promised for electricity has been in the main entirely fulfilled. It has proved itself capable of doing the most extraordinary work under the most unfavorable conditions. Grades of 12½ per cent., and more recently of 14 per cent., have been ascended with loaded cars. Grades three miles long, varying from four to eight per cent. have been ascended by a motor car pulling a tow car. It has done work where it would have been impossible to have done it by horses. It has enabled the running speed of cars to be increased even in crowded cities 50 per cent.; and on suburban routes speeds of 20 miles or more have been made. Experimental runs of 30 miles an hour on the ordinary street car with the narrow flange wheel have been attained; and on special experiments a speed of nearly 150 miles an hour has been made for a short distance. The electric car has shown that it can run faster on both up and down grades, that it can be gotten under way and stopped more quickly than a horse car; that with any given number of cars the mileage has been increased and the same time intervals made with a less number of cars. Horse space having been saved, the equipments occupy a third

less space, and this fact, coupled with the ability to back when necessary and again quickly gain headway, has enabled an electric railway car in crowded and narrow streets to work its passage where a horse car would be at a dead standstill. Not only has the possibility of running down grade faster been established, but that possibility with a high degree of safety, because in the event of losing control of a car by the brakes, the instant reversal of the motor will bring the car to a standstill. This has frequently been the experience, and in one case which was recently reported to us, the inspector stated that a car was going nearly 35 miles an hour on the down grade before the driver attempted to reverse his machine; but when he did reverse it, he brought his car to a standstill with the loss of only one gear. Making due allowance for the possible excitement of the inspector, I think the car was moving at least 25 miles an hour when the reversal took place.

"The cost of operation has proved entirely satisfactory, and my early claim has been substantiated. In a paper read before the American Institute of Electrical Engineers, in August, 1888, and also in some earlier communications, I made an estimate as to the expense of operating a 30-car road, dividing these operating expenses under two heads: (1) Those belonging to the central station; and (2) what may be called the road operating expenses, the sum of the two constituting the total cost of motive power. In making this estimate I used extra care, and while preserving its accuracy, made every reasonable allowance that I thought necessary. The conclusion at which I arrived in the estimate under the conditions there given, was that the total cost of motive power per car mile should not exceed $4\frac{7}{10}$ cents; and this included everything except executive and salary expenses, taxes and insurance, and other matter not connected with motive power. I also stated that this was about 40 per cent. of the cost of operating by horses for the same mileage, and under the same conditions. My estimate was then considered altogether too liberal in favor of electricity. Without going into details, I may state that the most reliable possible records of roads, under every possible condition of service, bear out the claims that I then made as to the economical operation by electricity."

Mr. Sprague then dwelt at considerable length upon the existing differences between the electric railway companies and other electrical interests. "I have been frequently asked whether, in my opinion, electricity will ever be used on trunk lines for through passenger or freight traffic? My answer is: Probably not, according to present notions of trunk line transportation, and not by present means of train dispatching. But in these qualifications I admit my hope and expectation of rapid transit under certain conditions." Then followed a comparison of steam and electrical methods of railway propulsion, which concluded as follows:

"Having thus touched upon the characteristics, such as I would propose for a railway system of this character, let us resume the consideration of the proposed line between New York and Philadelphia, and try to form some idea of the electrical pressure which would be required, the service which could be demanded, the number of cars which could be handled, the speeds which could be maintained, and the number of stations which would be required to operate the stations. We will assume, for the purpose of this investigation, an overhead conductor in the form of a solid rod, one inch in diameter, over each track, or, if you please, a smaller rod over each track, and a main conductor making up on equal weight, and a track of equivalent capacity. I take this arbitrary size because it is convenient for the purposes of our calculations, and because it falls well within the limit of expenditure which such a system would warrant. For instance, the American Bell Telephone Company has a line of long distance telephone wires running from New York to Boston, a distance of about 300 miles, nearly three and a half times the distance which we are considering. On these poles are about 70 wires each of No. 12 copper. The aggregate area of these conductors is over 800,000 circular mils, and the total weight of copper on this line, which is used simply for telephonic purposes, is about 40 per cent. more than the weight of two copper rods, an inch in diameter, running from New York to Philadelphia. If the investment is a reasonable one in the telephone system, cannot we certainly consider it a reasonable one in that larger field of the transmission of power of which we are now speaking.

"As I have stated, of the number of trains which in 13 hours leave Jersey City for Philadelphia, 12 usually make only one or two stops. Allowing 60 cars, this would be about one car every 13 minutes. This interval of 13 minutes is nearly as short as would be desirable between cars running at an average speed of a mile a minute, no matter how perfect the block system, and it would be necessary to run these cars in double car units. We will assume for our purposes the size of a car such as is used on the elevated road in New York or the Brooklyn Bridge, which would, with motor and passengers, weigh from 20 to 25 tons, or a total of say 50 tons for our unit. The formula to determine the size of conductor for a single transmission of car is:

$$cm = \frac{15{,}666\ n\ l}{E\ v\ q_1}$$

where n — the number of horse-power, l — the distance in feet, E the potential at the motor, v the fall in potential and q_1 the commercial efficiency of the motor. If we assume the station situated in the middle of a line, that is, at the best point, and the work divided equally at the middle section on each side, then l being the length of line, we have the formula:

$$cm = \frac{15{,}666\ n\ L}{4\ E\ v\ q_1}$$

"This will be practically the same if the work is distributed over the entire line.

"If more than one station is used, then the formula will become

$$cm = \frac{15{,}666\ n\ L}{4\ E\ v\ q_1\ S^2}$$

that is, the size of the conductor would vary inversely as the square of the number of stations, if properly distributed. v may be expressed as a fraction of E, and for practical purposes we will let $v = \frac{1}{5}$ of E, and q_1 such that

$$\frac{15{,}666}{q_1} = 16{,}800,$$

that is, q_1 = about 93 per cent. Then we have

$$cm = \frac{37{,}800\ n\ L}{E^2\ S^2}$$

which may be expressed thus, that the size of the wire varies inversely as the square of the product of the number of stations and the electro-motive force.

"We may also note that with any fixed size of conductor the electro-motive force and the number of stations vary inversely—a somewhat important fact to remember.

"We have another formula, one for the power required by a moving car, which is

$$hp = \frac{4}{75} w m \left(c + \frac{t}{20}\right)$$

where w — the weight in net tons; m, the miles per hour; c, the percentage of grade expressed as a whole number, and t, the traction in pounds per net ton.

"As I have stated, we will assume in this formula that c equals zero, a consideration in which I am justified in express service on a road of the character I have outlined, with the relation of grades and traction given, and with the method of braking I have described. Our formula would then become, using 10 lbs. per ton as our average traction,

$$hp = \frac{2}{75} w m$$

which, substituted for n in the distribution formula, gives us

$$cm = \frac{1{,}008\ w\ m\ L}{E^2\ S^2}$$

or substituting for L, 5,280 d, d being the number of miles between stations,

$$cm = \frac{5{,}322{,}240\ w\ m\ L}{E^2\ S^2}$$

we have assumed for our conductors two rods an inch in diameter, and that the rail has the same resistance. Hence, substituting for cm its value, 2,000,000 we have

$$E = \frac{2.66112\ w\ m\ d}{S^2}$$

or

$$E = \frac{1.631}{S} \sqrt{w\ m\ d}$$

"It will be noted that m, w and d, that is number of miles per hour, weight handled, and distance over which operated, are all affected in the same way. Hence, with any value of E and S, we can vary the relative values of w, m and d, so long as we do not disturb the product. That is, we can halve the number of miles and double the speed, or double the distance and halve the running speed, keeping the weight hauled the same, and so on. For w, the total weight, we can substitute the weight of each unit, c, and the number of units, b, thus making the formula

$$E = \frac{1.631}{S} \sqrt{m\ b\ c\ d}$$

"For the line proposed, $d = 90$, and we have

$$E = \frac{15.56}{S} \sqrt{m\ b\ c}$$

"Taking our unit of two cars at 50 tons, the time intervals between them at ten minutes, and 60 miles per hour as the mean speed, we have on the whole system 18 active units of two cars each, and $m\ b\ c = 54{,}000$, which substituted in our formula gives

$$E = \frac{3{,}615}{S}$$

which means that with one station in the middle, the potential at the most or farthest from the station would be 3,616 volts, and near the station one-ninth higher. Can we handle it? Yes, in time, but perhaps not yet. Nor is there any necessity for doing so; for if we increase the number of stations and go to a three-wire, instead of a two-wire system, making the track the balance of circuit, we would have the motor potential as expressed by the following table:

Stations		Motor Potential	
Number.	Miles apart.	2-wire.	3-wire.
1	..	3516	1808
2	45	1808	904
3	30	1205	603
4	22½	904	452

which last brings us down to ordinary street car practice, which is only the beginning of what will be done in the effective handling of potentials.

"So, after all, it does not seem such a serious electrical problem, and certainly not one to shrink from.

"We can in another way illustrate the influence of the position and number of stations and the potential used. Suppose we had a station at Jersey City to supply the entire line at a certain potential over a conductor of the required size. If the station be moved to the center, the weight of copper necessary is only one-quarter. Use two stations properly spaced and the weight is quartered again. Double the potential and the weight is further quartered. Now use the three-wire system and the weight is again quartered. So that by these very simple processes the original weight has been reduced $\frac{1}{64}$ of the original.

"I don't think I need to point out further the use of a proper determination of electrical values in a problem of this character.

"We see then that the supposititious case is well within the range of possibilities. A 60 mile express service every 10 minutes instead of a 40 or 45 mile service every hour would revolutionize travel. Of the comforts of such a system I need not speak. That it will in the not very distant future be a fact, I know you all agree with me in hoping."

A discussion of some length then followed, being principally participated in by the lecturer and central station representatives.

Electric Phenomena of the Heart.

A special meeting of the Berlin Physiological Society was called by Prof. Dubois-Reymond on December 27, in order to see a demonstration, by Dr. Augustus Waller, on man and other animals, of the electromotive action accompanying the beat of the heart. Besides the ordinary members of the society, the leading physicists of Berlin were invited, and Profs. Helmholtz and Kundt witnessed the experiments. Dr. Waller employed the capillary electrometer, the indications being magnified 1,250 times and thrown on a ground glass screen in one of the lecture rooms of the Physiological Institute, and demonstrated the electro-motive action of the heart in a horse and in a dog. The horse stood in a courtyard near the lecture room; electrodes were attached to his extremities by firm bands, and the wires from the electrodes were passed through the window to the electrometer in the preparation room adjoining the lecture room. The dog stood in the lecture room. In the library of the institute, Prof. Dubois-Reymond allowed the demonstration to be made on himself, so that the pulsations might be seen directly through the microscope by all the members present. Mr. Waller's work in this direction is well known, and formed the subject of his introductory address delivered at St. Mary's Hospital, at the opening of the session, 1888-89. A Montyon prize was afterward awarded to him in Paris for his investigations.

.... At the twenty-first annual meeting of the Dominion Telegraph Company, held recently in Toronto, the following report was submitted as showing the financial standing on December 31, 1889:

LIABILITIES.

Capital Stock paid up	$1,000,000 00
Mortgage Bonds, £60,000 Sterling (to be redeemed by the Lessees in 1890)	292,000 00
Dividends unclaimed	1,386 39
Dividend No. 54, payable January 15, 1890	15,000 00
	$1,308,386.39
Balance at credit of Profit and Loss Account	3,393 70
	$1,311,780 09

ASSETS.

Capital Expenditure	$1,281,819 47
Toronto, Grey & Bruce R'y Co. 1868 Bonds, and interest thereon	1,596 24
Cash in Bank and on hand	28,364 38
	$1,311,780 09

Respectfully submitted,

F. Roper, Secretary. Thomas Swinyard, President.

Toronto, February 11, 1890.

TELEGRAPHIC

.... The Commercial Telegraph Company have been increasing the number of their lines running into Lowell, and are to have a new office at the corner of Market and Central streets.

.... The Postal Telegraph Company has completed its line to Emporia, Kan., and has opened up an office there. The company is pushing its lines forward, with Galveston and Salt Lake City as termini of the two principal lines. At Salt Lake City the line will connect with the company's lines, the company already having a system in operation on the Pacific coast, and operated around by St. Paul to New York.

.... "Hello!" "Hello!" "Give me 1047, call six, please." "All right." A lapse of a moment or two followed by first voice redivivus. "Is that you, dear?" "Yes, what is it?" "What day of the month does St. Valentine's Day come on, please?" "The seventeenth of March, my love. Is that all?" "That's all; thank you." And the misguided wife has put off buying until just before the date of the wearing of the green.

.... J. F. Kelley, the general sales agent for Edison-Lalande batteries, has issued a neat little price-list and descriptive circular setting forth their merits. It has been said that no one battery is suitable for all kinds of work; open circuit, closed circuit, high resistance circuits, low resistance circuits, and so on through the list. It is claimed that the Edison-Lalande Battery has, by its achievements, proved this remark no longer true; that it is a universal battery and suitable for all kinds of work.

.... The attorney for the San Francisco Underground Conduit and Electric Light, Telegraph and Telephone Company, has applied to the city officials in behalf of said company, for a franchise to lay pipes for underground wires in the streets of that place. For this privilege he was authorized to offer two per cent. of the gross receipts of the business, and also the use of the proposed conduits to all other companies on the same terms, thereby doing away with the possibility of a monopoly. It was stated that if the franchise were granted work would be commenced at once, all necessary capital being at hand. The committee resolved to defer action in the matter for two weeks.

Telephones vs. Electric Railways.

When the General Term reconvened last week at Albany, with Presiding Justice Learned and Associate Justices Landon and Mayham, on the bench, a decision was handed down in the case of the Hudson River Telephone Company *vs.* The Watervliet Turnpike and Railroad Company. Injunction continued for 30 days and until stipulation and bond as provided for in opinion; no costs. Opinion by Landon, J. Order to be settled by Learned, P. J., and Landon, J., on two days' notice. The practical effect of the decision is to vacate the injunction, giving 30 days to the Telephone Company before the order shall take effect within which to construct a metallic circuit, that being in the judgment of the court the most practicable way of dealing with the difficulty that exists in concurrent use of the telephone and railroad systems and being cheaper and more effective than the double trolley system would be upon the railroad. The railroad company is to file a stipulation that the question as to the cost of construction of the metallic system and as to whether the telephone company or railway company should pay, or in what proportion they should pay for construction, may be inquired into on the trial of the action. The railway company is to give a bond to assure the payment of whatever, if any, sum it shall be called upon by the final judgment of the case to pay toward the construction of the metallic system by the telephone company.

* * Electricity will be adopted as the motive power for the new lines of the Pittsburgh, Allegheny and Manchester Street Railway Company.

* * Work was begun last week on a new electric street railway, which will run from Garfield, through Passaic to Clifton, and thence to Clifton race track.

* * The United States Senate has passed the bill authorizing the Eckington road to extend its line to the Treasury Department. This bill allows the use of electricity by any system that does not require the use of overhead lines.

* * The St. Paul papers are making a great fuss about the new electric lines just started in that city. One three-column article illustrates the old method of transportation by a picture of a bob-tail car being dragged by a horse and pushed by a portly conductor. In the next column is a picture of an electric train running smoothly along under the overhead wires. The spirit of electricity is represented as a large tiger walking on a trolley wire, "He is dangerous to think of, but perfectly harmless if you let him alone."

* * An illustration of the adaptability of the electric motor was recently afforded in Chicago. The engine and boiler of a printing company had been wrecked by an explosion. Had they been obliged to wait until the new boilers could be set up and got ready, and the engine overhauled and repaired, it would have caused a delay of a month, and the loss in failing to fill contracts on time, and the loss to employés by being thrown out of work, would have been greater in money value than the loss caused by the wreckage. The situation was promptly realized, and a 40 horse-power electric motor was placed in the building and connected with the shafting, and the next morning the office was in full work. Instead of a month's delay, one day had been sufficient to make the necessary change.

Why the Blacksmith's Apron is Slit.

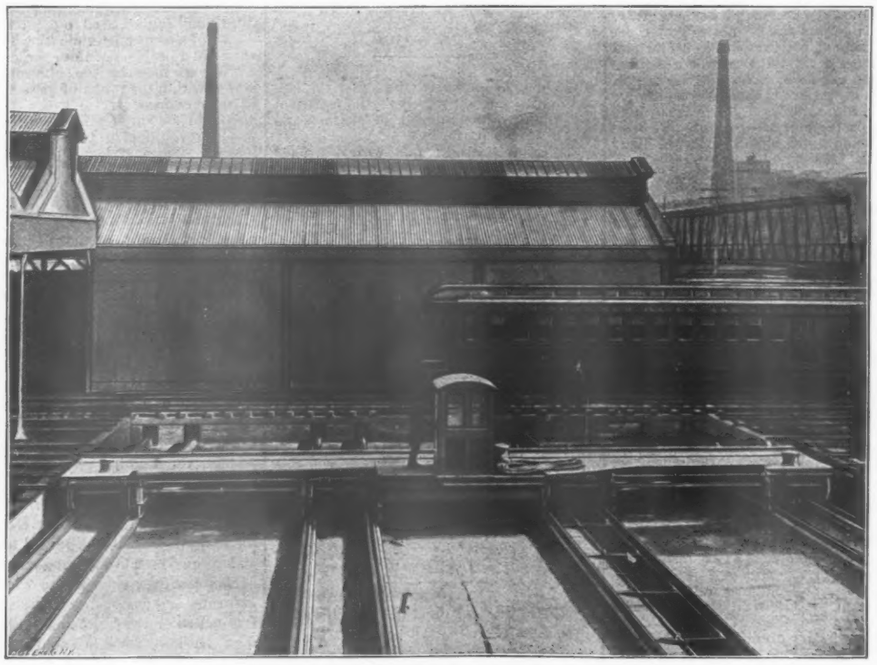
Every one knows that a blacksmith wears a leather apron, and must have noticed that this apron is slit and often fringed at the bottom. As an English legend, it is related that, once upon a time, Alfred the Great called all the trades together to appoint a trades-king. He declared he would make that man king who could best get on without the help of others for the longest period. He made a feast, and asked a workman from each trade to come and bring a specimen of his work and the tools used in making it. The blacksmith brought a hammer and a horseshoe, the tailor brought his shears and a new coat, the baker his peel and a loaf, the shoemaker his awl and a new pair of shoes, the carpenter his saw and a nice box, the butcher his chopper and a joint, the mason his chisels and a carved stone. The tailor's coat was of such surpassing beauty that all the guests declared themselves beaten; and the horseshoe, the bread, the shoes, the box, the meat and the carved stone, were all thrown aside. The tailor was pronounced trades-king by Alfred, and was duly installed. The blacksmith was angry, and declared that he would do no more work while the tailor was king, and he actually shut up his shop and disappeared.

One day, as King Alfred was riding along, his horse cast a shoe, and he was the first to need the services of the blacksmith, but he could not get into the shop. Then all the other tradesmen, including the tailor, tried to shoe the king's horse; but each one not only failed, but broke his tools, and could not carry out his proper business until they were mended.

King Alfred and the tradesmen then broke open the shop and tried to use the blacksmith's tools. The king tried to shoe his horse, the tailor to mend the shears, and each one endeavored to repair his tools. The horse kicked the king, the tailor bruised his fingers, the fire would not burn, and everybody got into everybody's way. The butcher shoved the baker, he shoved the shoemaker, who in turn shoved the carpenter, who shoved the mason, who shoved the tailor, and in the general confusion the anvil was knocked over.

About this time the blacksmith walked in, looking very angry. The King, however, made a humble bow, and said: "I was wrong to be led away by the gaudy color of a coat, and I now revoke my decision and proclaim the blacksmith king." All the trades, except the deposed tailor, begged the smith to mend their tools. So he shod the King's horse and mended the tools of all who had asked him; but, in order to show his magnanimity, he made the tailor a brand new pair of shears. King Alfred proposed to drink the health of the new king, and to sing a song to his honor at the second feast which he gave.

The tailor, however, did not reciprocate the blacksmith's kindness, but, while the others were singing, crawled under the table and slit the blacksmith's leather apron, and cut the lower edge into a regular fringe. From that day no true blacksmith has ever thought of wearing an apron that was not slit and fringed at the bottom.



Electric Motor for Transfer Table.

Electric Transfer Table.

We illustrate in this issue an electric transfer table, recently installed by the Sprague Electric Railway and Motor Company, for the New York Central and Hudson River Railroad.

These tables differ from the earlier ones, which have been described in these columns, chiefly in the electric motor, which is of 15 horse power, instead of 7½ horse-power, and also in the contact arrangement. The contact is obtained from a couple of heavy copper wires stretched taut, about three feet apart, over the second of the four parallel tracks, the wire being carried on insulators fixed to light cast iron cross beams, so as to be a few inches above the rails. The conductors are kept taut under all changes of temperature, by springs at one end. Over these wires two contact rollers travel beneath the table, being kept in contact by gravity only. In the Altoona electric transfer table, installed by the Sprague Company for the C., B. & Q. R. R., there is an outer contact maintained by springs, while at the Waukesha electric transfer table, installed for the Wisconsin Central R. R. Company, there is an overhead contact. The current used is only 220 volts, and hence, while not wholly pleasant to take in one's body, it is in no way dangerous. The current is taken from the same dynamo that furnishes light for the station.

The full current capacity of the table motor is 60 amperes.

The speed of the electric motor is governed by a switch which throws the winding of the field into different combinations, thus altering the current, maintaining a practically constant strength of field without the use of any wasteful resistance. The control over the speed of the motor is perfect, and no complicated nest of gearing for changing speed is required.

The motor is supported at one end, according to the regular Sprague method, by double compression springs playing upon a bolt which rests upon the platform of the transfer table. This method has been developed in street railway work and other places where it is desirable to start slowly under a heavy load, and has proved very satisfactory. At the other end the motor is sleeved on to a rigid support. By means of this flexible attachment all danger of stripping the gears is eliminated, and the strain upon the gears is always a progressive one.

The advantages of electric power for this work are claimed to be great. The equipment is very much lighter than if steam power were used, and there is no expense of operation when the table is not in use. One man can easily handle the table, and more conveniently and directly than with steam.

The two end capstans, shown on the cable, are fixed; the center one is revolved, in either direction, by a simple clutch gear. It is used, of course, for working cars onto or off the table without locomotive power.

The capacity of the table is 100,000 pounds. Ordinary car axles, bearings and wheels are used throughout for the running gear, and the total cost of the table and motor complete was under $7,000. Its speed is about 150 feet per minute, the same as the old wire rope table which it replaced. The old pit was lengthened somewhat, and accommodates ten tracks. The rails are carried on wooden longitudinals resting on small masonry foundation walls. The pit drains directly into the city sewers.

The table is constructed with 15" cross-beams and 12" longitudinals, thoroughly braced with a rigid lateral system. It was designed and built by the Yale & Towne Manufacturing Company, of Stamford, Conn.

The small cabin, shown at the center of the table, is provided for the operator.

Electric transfer tables have now been adopted by the Pennsylvania R. R. Co., Philadelphia & Reading R. R. Co., Chicago, Burlington & Quincy R. R. Co., Wisconsin Central R. R. Co., and other prominent corporations, and they are now recognized as an essential feature of every extensive and well-equipped railway switch yard.

* * A funny man got loose the other evening in Boston and placed a railway torpedo on the track of an electric railway, and the explosion, when a car passed over it, alarmed the passengers, and detained travel on the road while an examination of the motor, in search of injury, was made. The funny man has not yet been found—or the joke would be carried still farther—that is, to jail.

A Court of Appeals.

To the Editor of Electrical Review:

Various attempts have been made within the past few years to obtain such legislation from Congress as will ensure a more speedy and satisfactory trial of suits involving the rights of patentees. Among other plans proposed is that in which various electrical men have been more particularly interested, namely, the establishment of a court of patent appeals. The difficulty with securing such a court must be seen by everybody, when there is brought to their attention the knowledge that many influential persons are disposed to look with great disfavor upon anything connected with patents. They would prefer the repeal of the patent law, rather than the granting of any farther privileges to patentees as a class. Class legislation is never popular, and there is no reason why legislation in favor of patentees should be an exception to the rule.

It seems, therefore, that if there can be devised a scheme for relieving the over-burdened Supreme Court of the United States, which will appeal alike to all persons who have business in the United States courts, there will be a much greater chance for success than if the bill establishing a court of patent appeals be pushed. To accomplish the end desired, various bills have been introduced in Congress heretofore, and some of them have been very nearly successful. Had it not been for the jealousy which one political party has of the other, we should undoubtedly now have a court of appeals, the decision of which would be final in most cases, but from which appeal could still be taken to the Supreme Court in those cases where the importance of the question involved justified it.

To further such litigation, a meeting of the bar of the circuit court, in the district of Massachusetts, was recently held, and a committee appointed to consider and report what changes in the judicial system of the United States they would recommend for the approval of the bar. The committee was headed by Judge Lowell, and represented in its membership specialists in the various branches of law with which the circuit court has to deal, the patent bar being represented by Causten Browne, Esq., and Col. Thomas Wm. Clark. This committee made a report, a copy of which is hereto annexed, and which is in general accord with the opinion of the bar in other parts of the country. This report was unanimously accepted, and a copy has been sent to the judiciary committees of both Houses of Congress.

It seems worth while to bring this matter to the consideration of all your readers, as every influence should be brought to bear upon Congress to have some legislation of the proposed kind carried forward. While it might be very desirable for certain reasons that inventors and patentees should have a

court of their own to determine questions relating solely to their specialty, it is more important that the general legal business of the country should be advanced. The legislation proposed by this committee, while it will undoubtedly be of great advantage to litigants in patent cases, will be of equal advantage to other litigants, and consequently should command the help of all business men as well as members of the bar. Certainly to men whose business is connected with electricity the legislation will appeal, not only because of any effect it may have upon their general litigation in the United States courts, but also because of the effect which it will have upon the settlement of their patent litigation. It is to be hoped that they will exert themselves for the passage of a bill covering the points made by this committee, a bill in its nature popular, the passage of which may be secured by concerted action, rather than waste their energies upon the bill to establish a court of patent appeals which will almost certainly be defeated.

The following is the committee's report:

We have been furnished with copies of seven bills introduced into the House of Representatives at this session and of one presented to the Senate.

Two of these bills are copies of the Davis bill, and the other five are modifications of that bill, substantially like those proposed when the subject was last before Congress. These five are H. R., Nos. 97, 834, 961, 5,354 and 8,190. They differ somewhat from each other, but they all adopt the existing circuit court as the court of appeals, and give all original jurisdiction to the district court, which gives a system more simple and convenient than the original Davis bill. The following provisions, which we recommend, will be found in one or other of the several bills, and it will not be necessary to refer to them more particularly.

1. We recommend the adoption of the general plan of transferring all original jurisdiction to the district courts.

2. There should be at least two additional circuit judges in each circuit.

3. No question of fact should be carried to the Supreme Court, except by permission of the circuit court.

4. Circuit judges should be assigned to try causes in the district court, when the presiding justice or judge of the circuit finds such assignment necessary.

5. An appeal or writ of error should be granted as of right, when one circuit court differs from another upon a question of law essential to the merits of any cause.

6. Appeals from the district to the circuit court in criminal cases should be allowed only in these districts in which such appeals are allowed in the State courts. In all other districts the remedy should be by writ of error. Appeal in such cases, after a jury trial, is unknown in many districts.

7. It is not expected to increase the amount necessary to give the Supreme Court jurisdiction, if it can be avoided. The effect of the new legislation should be first ascertained in the hope that this method may prove unnecessary.—Signed by John Lowell, Thos. Wm. Clarke, Chas. Theo. Russell, Patrick A. Collins, Causten Browne, Henry W. Putnam, Lewis S. Dabney. G. O. G. COALE.

Boston, Mass., March 1, 1890.

Trouble Over a Franchise.

For some time past the Rosedale, Kansas, council has been wrestling with an ordinance, which, if passed, would grant to the Consolidated Electric Light Company a very liberal franchise at that place. So liberal is the franchise that when the ordinance was passed at a recent meeting, popular indignation ran so high that the council reconsidered its vote. Last week the aldermen were about to pass the ordinance again, when a delegation of 200 people checked legislation by breaking up the meeting and creating a riot on a small scale, even severely administering punishment to officers of the law who attempted to interfere.

It was just about 8.30 o'clock when the clerk began a roll call for a vote on the franchise, and the first alderman called voted in its favor. There were loud cries of "Boodle! Boodle!" and the assembled crowd broke over the railing, fiercely hurling epithets at Mayor Barnett, who attempted to interfere. Marshal Potter was called in to restore order, but the crowd toyed with his edifice until it was out of shape and the floor had been neatly wiped up therewith. The six aldermen took to flight by every practical means of exit.

It was the original intention of the crowd, subsequently learned, to take the mayor and councilmen to the creek near by and give them a thorough ducking, but wiser counsel prevailed. Great excitement prevails in Rosedale, and interesting developments may be expected.

Statistics.

During 1888, 231,270,622 pounds of copper were produced in this country. The value at New York was $33,833,954.

The Central Spark Arrester.

The accompanying cuts illustrate a device to keep sparks from dropping from arc lamps. Complaint has frequently been made that sparks have fallen and damaged or destroyed goods over which the lamp was suspended, and in many cases the use of arc lamps for indoor lighting has been discontinued by reason of this danger.

The Central Spark Arrester rests upon the top of the globe and reaches up to and

FIG. 1.—ARC LAMP SPARK ARRESTER.

around the cylinder of the lamp, enclosing all the intervening space, and absolutely prevents the escape of the heated particles of carbon. It is made to fit any inside frame lamp, and all outside frame lamps where the cylinder is suspended from the inside of the top of the frame.

Fig. 1 shows the arrester removed while the lamp is being trimmed. Fig. 2 shows

FIG. 2.—ARC LAMP WITH SPARK ARRESTER

the arrester in position upon the lamp. A rubber flange or apron fits tightly around the top of the globe, and the body of the arrester being of wire-cloth, there is a free escape for heat. This device is being introduced by that enterprising house, the Central Electric Company, Chicago.

MANUFACTURING NOTES.

The Connecticut Motor Company.—The factory and general offices of this company are at Plantsville, Conn., and the New York office, 17 Broadway. The motor is one of the best in the market, and is popular wherever introduced. Mr. Robt. E. Dunston, an electrical engineer of experience and ability, is the president of the company.

The Evans Friction Cone Company had their representative, Mr. H. J. Conant, at the Kansas City Convention to explain the workings of their system as applied to dynamos. Mr. Conant was well supplied with photographs of plants which the company had fitted up, and the principles of the system were easily made plain. The Evans system attracted the attention of all practical men of the Convention.

The Westinghouse Electric Company's arc lighting business has largely increased since they brought out their new system. Among the latest contracts is one for a 60-light arc machine for Denison, Texas, and another from Saratoga, N. Y., for the same kind of a dynamo. The plant in Saratoga Springs is a new one and it will be furnished exclusively with Westinghouse apparatus, the incandescent light capacity amounting to 1,500 lamps.

OUR ALBANY LETTER.

ARGUMENTS AGAINST ELECTRICAL EXECUTION—NEW LEGISLATION IN RELATION TO ELECTRICAL MATTERS.

Albany, February 24.—The Assembly to-night passed Senator Hunter's bill to allow the Seneca Electric Railway to use electricity as a motive power. The measure having gone through both houses, is now in the Governor's hands. Assemblyman Larman introduced a bill allowing electric light and power companies to maintain and operate railways for freight and passenger traffic where the only motive power is electricity. The companies are to be subject to the provisions of the act for the formation of railway companies.

The Senate passed the bill allowing the Lockport Water Company to supply electricity.

February 25.—To-day the Assembly committee on gas, water and electricity, decided to give a hearing on March 11, at 3 o'clock, on Assemblyman Whipple's electrical control bill, and other electrical bills.

In the Court of Appeals to-day the appeal in the Kemmler case, from the law of execution by electricity, was heard. The Hon. William Bourke Cockran, Kemmler's counsel, argued that the infliction of the death penalty by electricity comes strictly and literally within the constitutional prohibition. It is an unusual penalty, for never before in the history of the world, so far as that history can be traced, has there been an attempt to inflict a similar one. The terms of the sentence are in themselves so unusual that they are incomprehensible. The words "current of electricity" are at best but a figure of speech. No human being understands what a current of electricity is; its very existence is a matter of dispute. Mr. Cockran reviewed the testimony of the witnesses for the State and concluded that the whole evidence may be summed up as establishing beyond dispute: First, that unless death be immediate, torture will be exquisite; and second, that no means have yet been discovered by which immediate death can certainly be produced. The punishment is unusual, and may be cruel. The constitutional inhibition renders any law passed by the Legislature, in violation of its provisions, unconstitutional. It being conceded that the infliction of the penalty will expose the relator to the risk of torture, the sentence is in violation of the constitution, and therefore void. The legislative act is unconstitutional, because upon its face it provides for the infliction of an unusual penalty.

Attorney-General Charles F. Tabor presented the State's side. He held that the evidence, so far from indicating that the infliction of the penalty of death by the application of the electric current would be a cruel punishment, demonstrates affirmatively that such method of inflicting the death penalty will be certain, instantaneous and painless. He defended the testimony of the State's witnesses, and said that the knowledge of electricity is a science, adding: "We think that it may be assumed that perfectly well established facts, matters of the every-day experience and observation of men, pertinent upon the questions involved here, will not be ignored by the court in this proceeding."

February 26.—Assemblyman Mullaney introduced a bill, granting power to the commissioners of the sinking fund of New York city to sell privileges, permissions and franchises for placing hot water, steam or gas pipes, subways, conduits, cables and wires, or for the erection of poles for electric power wires.

February 27.—The assembly to-day passed Senator Hunter's bill, giving the Seneca Electric Railway the right to use electricity as a motive power. The bill now goes to the Governor.

Assemblyman Hoag, of New York, introduced a bill making it unlawful to take up the pavements of the city for the purpose of laying down electric wires without written permission from the Board of Electrical Control. The bill also makes it unlawful to place above ground any wires whatever, carrying currents that are dangerous to life and to property. The Board of Electrical Control is charged with the duty of enforcing the law, and can fine any person or company that disobeys, $150 a day.

Assemblyman Kelly introduced a bill to regulate the rental of electric light subways in cities having a population of 1,000,000 and upwards. It makes it unlawful to charge a greater rental than $500 per annum per mile for each duct having an inside diameter of three inches.

Assemblyman Sullivan, of New York, introduced a bill, which, if it becomes a law, will affect electric railway companies. It provides that in cities of 1,000,000 or more inhabitants, surface railway companies shall clean such streets as they use, from curb to curb. H. L.

Albany, N. Y., March 1, 1890.

ELECTRIC LIGHT NEWS

—— Low voltage arc lamps are becoming stylish.

—— Fargo, N. D., is advertising for bids for city electric lighting.

—— Electric lighting is gaining quite a foothold in the Southern States.

—— Lawrenceburg, Ind., is to have the Thomson-Houston system of electric lights.

—— Tallapoosa, Ga., celebrated Washington's birthday by lighting the city by electricity.

—— A dead wire commission is suggested in Pittsburgh. It is proposed that a man be appointed by each of the companies having wires in the city, and one by the city, whose duty it shall be to make a thorough examination of the wires in the city.

—— The Philadelphia city councils' electrical committee have agreed to report the ordinance to permit the American Subway Electric Company to construct manholes, and to lay and maintain underground conduits, cables and wires in certain streets.

—— The alternating current central station, at Savannah, Ga., has for some time been over-run with business, which has necessitated additional facilities. A contract was made a few days ago with the Westinghouse Electric Company for a 750-light machine. This gives the plant a total capacity of 3,350 incandescent lights.

—— The Suburban Light and Power Company, of Boston, Mass., is rapidly progressing with the installation of its machinery. The arc light apparatus, Westinghouse converter system, has nearly all been shipped, and the company contracted, a few days ago, for a 750-light dynamo of the Westinghouse alternating current incandescent system.

—— At the meeting of the newly elected directors of the Newark, N. J., Electric Light and Power Company, the following officers were elected: John D. Harrison, president; Marcellus Hartley, vice-president; Philip N. Jackson, treasurer and manager; Samuel S. Dennis, secretary. John D. Gaffney was re-appointed superintendent.

—— The Boston Valve and Motor Co. has been organized at Portland, Me., with a capital stock of $250,000; paid in, nothing. The officers are as follows: President, Wm. B. Chase, of Swampscott, Mass.; treasurer, Henry M. Nichols, Boston, Mass. The business of the new company will be the manufacturing and selling of an instrument known as the electric valve and shut-off and water and electric motor.

—— Chattanooga, Tenn., operators are taking great interest in the National Fast Telegraphing Tournament to be held in this city at an early date. A number of operators in the Western Union office engaged in a friendly competition recently. The following is the number of ordinary words sent by each of the operators in five minutes: R. A. Moore, 188 words; R. W. Park, 198 words; A. H. Candra, 191 words; H. L. Childress, 199 words. B. G. Lisle acted as referee.

—— The annual meeting of the stockholders of the Sims-Edison Electric Torpedo Co. has resulted in electing these officers: President, Everett Frazar; first vice-president, Hector de Castro; second vice-president, Gardiner C. Sims; secretary, George W. Casper; treasurer, W. M. Deen; general manager, W. Scott Sims; consulting electrician, Thomas A. Edison; consulting engineer, Gardiner C. Sims; trustees, Thomas A. Edison, Charles Batchelor, Gardiner C. Sims, Everett Frazar, W. M. Deen, W. Scott Sims, Ambrose Snow, Hector de Castro and George W. Casper.

"PATENT LAW, AND WHAT CONSTITUTES AN INVENTION."

ADDRESS OF MR. GROSVENOR P. LOWREY BEFORE THE ELECTRIC CLUB, FEBRUARY 20, 1890.—THE DISCUSSION.

Mr. President and Gentlemen of the Electric Club:

I.

In this audience the sound political economy of a patent right system is not likely to be doubted. Nevertheless, the first thing to be said about patent laws is, that many intelligent persons think there should not be any.

When the British patent act was before Parliament, a class of philosophers, by newspaper discussions, by books, and by arguments before committees, maintained that patent laws hinder and delay the development of art and manufactures. The question was in general treated simply—both *pro* and *con*—as one of expediency. Occasionally somebody pressed the claim of right, and argued that if the principle of ownership in things is to prevail at all—if the oyster dredger, who, by mere chance finds a pearl may possess it to the exclusion of others, then the creator of substantive inventions, which are pearls of greatest price, should not be denied a similarly beneficial ownership in the products of their thought and expenditure.

In all civilized countries the social scheme involves the idea of a permanent and exclusive possession of things movable and immovable, conceded to a person whom we call owner. That is the property idea.

Some advanced economists profess to demonstrate that there is no such thing as a "right"; and that these property privileges rest only on convention, and convention on expediency. Reduced to its simplest terms, what they say is, that human nature having developed a tendency in the stronger to seize and withhold from the weaker whatever was convenient, and it having become apparent that much valuable time was wasted in maintaining by force and watchfulness the conquests made by force and skill, it was found desirable to relieve this need for constant watchfulness by some other form of security. Uncertainty of tenure thus led generally to the evolution of a custom of conceding to the strong holder, title to tangible things in his possession which could be pointed out and identified. This was practicable because of the ease and certainty with which the *res* or thing could be pointed out. Once pointed out, and the conventional owner ascertained, and a sort of social assent to his title obtained, he and all other pretenders to the thing were free to go about their business, which was largely, no doubt, the stealing of more things good to have. The value of the concession was in time enhanced by attaching to it the privilege to transfer the title by sale or gift, and, finally, by inheritance. Thus, say these philosophers, the spurious ideas of inheritable, devisable and assignable interests in things called "rights" arose from what was merely an arrangement for expediency's sake.

Now, when society came, in times comparatively recent, to deal with an entirely new subject, the claim of an exclusive right to new ways of doing things, on the ground that the claimant was the first to think of the new way, difficulties arose from the fact that the new way is not a concrete thing like a plough or horse, or an acre of land, but an intellectual conception merely. The claimant of a concrete thing could stand over it with a club until his claim of right was conceded, and this made the problem, in respect to such things, easy to deal with, when society undertook to replace his club by a law. But when the job undertaken was the protection of a mere idea, liable to crop out in many places at the same moment, we can see that an entirely different problem was presented. The mode of affording protection was more difficult, and the grounds of expediency for giving any protection either did not exist at all, or were quite distinguished from those on which ordinary property rights rested.

Letters patent have now come into vogue for this purpose, but still the objection is heard. In England, as I have said, the objectors were of the philosopher class. Here they have been chiefly farmers of the West. A man who has given his note for a patented article which he does not want, and which, on trial, appears not to want him sufficiently to commend itself by working well, finds, in a claim for payment, a conclusive argument against all patent laws. He has a vote, and his congressional representative has several times been moved to introduce bills in Congress intended to annul all benefits of the law to the inventor, forgetting that in the clothing, feeding and housing of our bodies, the culture of our minds, the transmission of our thoughts, the maintenance of relations with different countries, in short, in all which distinguishes our present happy state, as compared with that of a rude ancestry, patented and patentable improvements in manufactures bear a preponderating part. Indeed, when we think of it, the ostensible function of life on this planet (so far as it can be seen without calling in the aid of religion and revelation—a call which probably could not be made unanimously in an electric club, without some risk of marring the harmony of the occasion) is to gain a more comfortable and easy subsistence, through improved methods of doing things. Whoever labors and contrives, or teaches, or runs, or waits ("they also serve who only stand and wait"), or practices any of the diversified forms of human industry, does it that he may get for himself and family more and better of the direct and indirect products of the earth. But as not all have the requisite endowments, a limited class serves the rest by improving, in their quality, or price, or convenience, or adaptability, the things which we use, and to obtain which we labor. Thus, better bread is needed, and it comes from improved means of preparing the ground, of sowing, reaping, cleansing and grinding the grain, and of preparing, baking and serving the loaf. I wish my knowledge enabled me to trace the inventor through a history of a mouthful of bread. Consider the day when (our ancestors having learned from the animals that it was nutritive) the first cereal was eaten by man, as the horse now takes his oats. Probably some great inventor of the period improved this method, in course of time, by roasting the grain. Then, there came a time when some man—most likely, he was a woman—revolutionized the whole scheme of life within his environment by pounding the raw corn into powder, thus producing material for a fermentable dough. In view of the different sustaining powers of good beef, scientifically cooked, and raw meat, run down, slaughtered and devoured, in the malarial swamps of a prehistoric world, such a conception in the minds of a savage man would seem to have required as high mental energy as the conception, under more favorable circumstances, of Crompton's loom or Bessemer's furnace. These men had for stimulus the encouraging fact of experience that some things can be done as well as others. But our hungry primeval progenitor had no such extraneous ground of hope. The first bread maker was, of course an epoch maker; and a new breed of men must have started from the entrance of that refined food. The achievement was sufficient to base a new advance in civilization, and to close the history of a vanishing race. No provision for patent protection existed, but stone weapons—I think this happened in the stone age—may have enabled the bread inventor to carry on his operations for a considerable time as a secret process, if he desired. This is the plan which the anti-patent people advise the inventor to resort to as a way of avoiding the robbery, which, at the same time they project.

I will, presently, tell you of a notable case, in which a great inventor tried to dispense with patent protection, and to work his invention as a secret.

But, returning to our bread, let the imagination follow the history of that useful, agreeable, and sometimes nutritive factor in modern domestic life. From the rudest cultivation to the McCormick reaper, and from the scriptural two women grinding at a mill, to the first water mill, which, in the time of Augustus, excited Rome, as the telephone has excited our century, and thence to Frederick Wegmann's revolution of the milling art, by the introduction of the porcelain roller, what a path has been cut through obstacles by the indomitable spirit of inventive man! He has delivered over to us a regenerated nature. His art and industry enable the Western farmer, who wishes patent laws abolished, to be a Western farmer instead of an Eastern pioneer. His thousand achievements in inventions bearing upon transportation, make it possible for that farmer to own and cultivate with profit, lands which are, let us say, 1,000 miles and 100 hours from seaboard markets and ports. But for these, he would still be a frontiersman on this side of the Alleghanies—say a hundred miles and a *thousand* hours from the same commercial facilities. In his Western home, clothing, furniture, food, fuel, medicines, books, newspapers, all that make life happy, or, to the modern household, even endurable, come to him from the teeming brain of the inventor and discoverer, and most of it as patentable or patented discovery. He who has taught us how to traverse the seas quickly and safely; to cultivate the land more effectively, to weave, to grind, to smelt, to combine useful things, to sew by machine, to transport safely, quickly and cheaply, to manifest thought in widely separated places simultaneously, is the chief benefactor of mankind. His benefits come to us without any depletion of the world's assets, for thought consumes nothing which is salable. When the inventor lodges his descriptive specifications at the Patent Office, a clear addition has been made to the wealth of the world, and yet there is as much gold, silver, copper, coal, timber, etc., as there was before. Not only has the stock of material on hand not diminished, but probably all materials have been in some degree enhanced by the new use which the invention opens to some of them. If it is a process in metallurgy, the mining of ore is stimulated. Miners must be fed, clothed and furnished with tools; all these, together with the product, must be transported, and handled, and fabricated into forms of use. Thus one ripple of thought in an inventor's brain, stirs the whole body of commercial relations, from China, which furnishes the laborer his tea, to Massachusetts, which furnishes his shovel.

And this great worker and benefactor, who out of so little makes so much, is the only one, so far as I have heard, whose right to wages is contested by philosophers on principle.

Those who sustain this objection meet the accumulating difficulties of their case by a variety of irrational arguments, which there is neither time to speak of, or necessity to refute. I have already referred to one of the points, which is in the nature of what lawyers call confession and avoidance. It is said that the inventor would, in the absence of patent protection, continue to invent, and would obtain a sufficient reward through his natural advantage over competitors in the manufacture of the thing which he invents, especially as he would, doubtless, keep his invention secret. A large proportion of substantive inventions have originated in the brains of men not trained, or engaged in the art to which the invention relates, and who would, therefore, have to go into new business to avail of this advantage. Thus Watt was not a maker of steam engines, but a mathematical instrument maker; Arkwright was a barber; Cartwright, the inventor of the power loom, was a clergyman; Neilson, the inventor of the hot blast, was a manager of a gas works and in no way connected with smelting; Wheatstone was not in the electric telegraph business, but was a manufacturer of musical instruments; Bessemer was in no way connected with the steel industry. The fish joint, said to be the greatest improvement in permanent way made since railways were devised, was invented by a carriage builder. Let us try to conceive, now, of Bell keeping his process secret, or Edison hiding his light under a bushel! How could Bessemer have reaped the reward due to the great economy in fuel and capacity for high heat which his generative furnace introduced, except by patent protection? Should we have taken up the working of it? The universality of its application makes that impossible. His furnaces are in use for the making of wrought iron, of steel, of plate and flint glass, for copper melting, and for a great many other industrial objects requiring furnace-power. In short, the suggestion shows ignorance of the inventor's practical needs during the growth of his invention, and of the kind of security he must give to capital to obtain it. The last report of the Edison General Electric Company states that their patent rights show a cost of $1,032,010.17. Imagine Edison in 1879 going to even the richest man in the world, and saying: "I think, but am not sure, that I can invent what is necessary for a new system of domestic lighting. If we succeed it will be necessary that you should first lay out $———, and wait for a dividend of two per cent. until December, 1889. And you getting even the return of your capital will depend upon our being able to keep the art a secret while going into the business of supplying electric light ourselves in competition with the great and powerful gas industry. If I fail, your money will be all lost." The rich man would have said, doubtless: "You hold out an enticing prospect of *possible* profit, but my means are not sufficient to do this work and maintain such a contest, considering the uncertainty of profit." The very rich man has not only his capital, but his prestige to protect: and he is prudent. That is the sort of answer which the logic of financial history requires him to make.

If the prudent rich man knew it he could tell the story of Crompton, the inventor of the spinning mule, who adopted secret manufacture as his mode of getting compensation.

Crompton carried on work in secret at his house called the "Hall in the Woods." The neighboring spinners, seeing the product of the new machine, were greatly excited. They combined and tempted away his workmen, so that, to use his own phrase, he "was always teaching green hands." His house was barricaded, but they actually broke in to make drawings of the machines. They bribed his own sons to become their teachers and assistants. At last, wearied out with being a prisoner in his own house in a state of siege, he entered into negotiations, and engaged to reveal his secret for a sum of money. A subscription was raised for the purpose. Crompton kept his part of the bargain, but many of those who had promised to pay, failed in that, though they set up competition by means of the knowledge thus obtained. Years after, in his old age, the British Government, in view of the fact that Crompton had greatly benefitted mankind; that four to five millions of his spindles were then at work in the Kingdom, and that he had succeeded in collecting less than £106 on the subscription referred to, compensated him by a grant of £5,000. He had spent 30 years of his life in making this invention, and received therefor what would amount to £75 a year for the time employed, carrying over the account of interest and cash expenditures and disappointed hopes for reimbursement in a better world.

But this is more than enough on a topic about which nothing is necessary.

The anti-patent fad is disappearing among the philosophers. Most men are agreed that the first and true inventor of a useful thing shall have his patent if he can get it.

Before parting with this branch of the subject, it is proposed to point out some considerations which differentiate the case of the inventor from that of the artist, sculptor or author, and justify the granting of only a limited term to the farmer while the painter and sculptor receives and holds his work by a perpetual title. It is scarcely thinkable that two men should write the same book or paint the same picture, but it is a matter of common experience that several men, without communication and without knowledge of one another, should make the same invention or discovery. Manifestly, therefore, the inventor who gets first to the Patent Office does not so certainly give to the world something which it would not have received otherwise, as does the author and the artist. Besides this, it is not at all certain that in what is called the "race of diligence," the most meritorious gains the prize. Then, too, as in the case of Professor Hughes' microphone, some inventors invent with the intention of giving their inventions to the public, and, therefore, it may be that the fortunate patentee not only gets an advantage by his superior enterprise and facilities over other equally meritorious inventors, but also that he deprives the public of what would have been freely given to it but for his intervention.

Besides this, almost all inventions and discoveries rest upon the previous inventions and discoveries of others constituting the state of the art, and the last successful step may have less in it of invention than any of the preceding and unrewarded steps. I had a humorous Irish farmer in my employment once, who, with several men, was engaged in trying to lift out from its bed a large boulder. One notoriously lazy man let go his hold on the lever at an unpleasant moment for the others, and running round to the front, said, "Oh, I see what houlds it," and my farmer gave an answer which epitomizes the situation in almost all these inventions which are built upon nearly perfected conditions, and at last realize success by some slight and comparatively trivial achievement. He said, "Come back here, ye lazy divil. It's the lack of strength that houlds it." I have no doubt you will all agree when you come to reflect upon what may be called perfective or perfecting inventions, that the state of the art has almost always been brought up to a delicate waiting and critical point, where a lack of strength held it. The fortunate man is often he who sees the point of friction and supplies the lubricant

Upon all these considerations, therefore, there would seem to be some reason why, instead of delivering the world over to an absolute ownership of the inventor, as would soon happen if a perpetual title were granted for inventions, it has been thought that the general interest of society requires that such property shall be held by express and peculiar grant for a limited period.

Before considering for what a patent will be granted and maintained, it will, I think, be interesting to glance at the history of this way of encouraging inventors. I do not say of rewarding them, though that phrase is often used by higher authorities. We do not predicate reward of a system by which we compel a man to part with some part of what he has in possession, and of which he might keep the whole. Besides, no design to benefit the inventor or recognize him as possessing a right, appears in any English or American statute. It is a public object always which the State has in view in promoting legislation on the subject, and the private gain is only so much sacrificed to obtain more.

In a case decided in the reign of Edward III, it is said that arts and sciences being greatly for the public good, are favored in law, and that the King, as guardian of the public weal, has power to grant privileges for the sake of the public good.

The same principle is implied in the constitutional provision under which our patent act has authority. It is there provided that Congress shall pass laws to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries. The promotion of science and the useful arts in general is, of course, a public end. The advancement of this public end is the primary purpose, and the advancement of private interests is the secondary and incidental purpose of our patent legislation. The method of advancing the public end is to

give to the inventor for definite times the exclusive use of his invention, on condition that he will so describe it that it may be freely published after this time. The relation between the inventor and the State is one of selfish contract purely.

Patents covering monopolies of certain industries or arts had their rise long prior to the reign of James I, and were always petitioned for and received as a matter of grace and favor, and not of right. There are some curious instances of early patents, of which I will give you one or two.

A privilege granted to Aaron Rapburne, gent and Roger Burges for the term of xx; years next of the sole making, describing, carving, and graving in copper, brasse, or other metall all such and soe manie mapps plots or descriptions of Lond, Westrn, Bristoll, Norwich, Canterbury, Both, Oxford, etc.

A spiall privilege granted to Nicolas Hilyard Eut. His Mats servant and principal drawer for the small portraits and imbosses of His Mats medalls of gould.

Shewing that whereas in respect of his extraordinary arte and skill in drawing graving and imprintinge such pictures or representations of Hig Matie doth hereby grant unto said Nicolas Hilyard and his assigns free license power and privilege for the term of twelve years next ensuing x x x to invent make, grave and imprinte anie picture or pictures of His Mats image or other representacon of His Highness person as well as pap and pachment as in any other thing whatsoever x x x prohibytinge others to doe the same upon payne of forfeiture of all such pictures, etc.,

A speiall privilege to John Cason Esq., shewing that whereas he by his great change and industrie hath attained to the skill and pfeceon of a more apte and beneficiall means for the framing contriving and making of locks, sluices, bridges, cutts, cranes, mills, dams, and other invencons necessary and convenient for grindinge of corne, raising of water, makinge of rivers and streams navigable for boats x x x ets., and according-ly there is granted to Carson his executors, administrators deputies and assigns and prohibiting any others to do the same with any waters where he wants to build.

Monopolies of this sort, including something of industry or art, were inconspicuous amid the greater mass of commercial and trading monopolies, the right to grant which was equally claimed as a prerogative of the King. In the reign of Queen Elizabeth, as we are told by Macauley, the exercise of the prerogative, having been grossly abused, began to be questioned. The Queen wisely declining a conflict with the House of Commons on the subject, acknowledged there was reason for complaint, and cancelled certain patents which had excited public clamors. The people, satisfied with the gracious manner of the concession, did not require renunciation of the disputed prerogative. But the disturbances which her wisdom appeased were revived by her successor, who readily granted oppressive patents of monopoly. When he needed the favor of Parliament he as readily annulled them; and when Parliament had ceased to sit, his great seal was again put to instruments more odious than those which he had cancelled.

At length, in 1623, the Commons determined to apply a stronger remedy to the evil, and the King was forced to give his assent to a law ever since known as the "Statute of Monopolies," which declared all monopolies established by royal mandates null and void, as contrary to the laws of the realm—provided, however, that the statute was not to extend to letters patent and grants or privileges for the sole making or working of any manner of new manufacture within this realm, granted to the first and true inventor of such manufacture. This is the first formal and express recognition of patents for inventions in English law. It is a recognition in passing. In a sense it was the plucking of a brand from the burning. There must have been recognition at the time of a moral right in the true inventor to have supported this exception, although it is doubtless true that the political and religious affiliations of cloth workers and other artisans with the dominant party in the House of Commons, gave them what we should now call a "pull."

Prior to this statute, monopolies for inventions were granted of grace, not of right, to whoever brought the invention into the realm, without reference to whether he was the inventor or not. In the early case of the cloth workers of Ipswich, it is said that, "If a man hath brought in a new invention and new trade within the Kingdom, in peril of his life, consumption of his estate and stock, etc., or if a man hath made a new discovery of anything, in such case the King, of his grace and favor, in recompense of his cost and trouble, may grant to him by charter the whole use of such trade or traffic for a certain time, because at first the people of the Kingdom are ignorant and have no knowledge or skill to use it."

The proviso saved from the general destruction of monopolies the power to make grants "of sole working any manner of new manufacture," introduced a new rule in requiring the grantee to be the first and true inventor. The strict letter of the statute was, however, relaxed so as to allow persons who simply had imported inventions from foreign countries to obtain patents in respect to them as before—the administrators of the law reading the word "inventor" in the statute as embracing "Importers, or whoever for the first time makes known within the realm a new and useful thing." It was said in an early case, "If the invention be new in England, a patent may be granted, although the thing was practiced beyond the sea before, for the statute speaks of new manufactures within this realm, so that if it be new here, it is within the statute; for the act intended to encourage new devices useful to the Kingdom, and whether learnt by travel or by study, it is the same thing."

For a long time after the Statute of Monopolies, the value of the exception in favor of new manufactures was slight, for manufactures languished, and invention, as we now know it, was virtually unborn.

The number of patents granted during the last eight years of the reign of James I, and the first nine of the reign of Charles I, was about 12 per annum. They disappeared altogether—quite naturally—during the latter part of that reign. There were four per annum during the reign of Charles II; 21 per annum during that of William and Mary; two and a half per annum during that of Queen Anne; an increase to 31 per annum in the reign of George III, and, finally, in 1799, there were 96. From 1623 to the beginning of this century, the grant of such patents in Great Britain was only 1,707.

No important judicial decision of a patent question *per se* appears before the reign of George III, and it was not until 1795 that a really important question of infringement appeared.

In 1789, our Constitution conferred on Congress power to pass laws "to promote the progress of science and the useful arts, by securing to inventors for limited periods a monopoly in the use of their discoveries;" and in 1790 the first patent act was passed. Since that time amendments and modifications have perfected the statutory expression of the law, which, as it now appears in the Revised Statutes is, on the whole, simple, just and liberal, and with a few amendments might be a model to the world.

II.

Patent law to be found in the Statute is but a limited part of patent law. It is chiefly judge-made law, and is found in numerous volumes devoted to reports of cases which the statute does not, and which no statute ever could, determine.

A traveler who should take a canoe on the upper waters of the Hudson River to explore its length, would be capable to observe for a part of his course, the chief objects of interests—the isolated houses and farms and occasional villages. But when he should have entered upon the waters surrounding New York, no power of observation could, in such a journey, enable him to note the streets and houses, the facts and details of commerce and intercourse carried on therein, the ships, the coming and going of railroad trains, etc. His account of this part of the voyage would necessarily be so lacking in particularity as to be valueless to readers who already know in general about Manhattan Island and its surroundings.

So in considering the history of a growing system of laws intimately related to the industrial development of our race, the early stages of that growth may be easily seen and described. But when we reach the year 1790, and the passage of the first United States Patent Act, the subject seems to take a plunge like Niagara, and afterwards to spread itself over vast levels, whose shores cannot always be seen. Most members of this Club know in a general way all the provisions of our patent acts, and a resumé of these provisions could only be in the nature of an inventory, paraphrasing the simple language of the law itself. The discussion of particular questions is what you would like to hear, possibly, but when we speak of particular questions, we must first consider what it is which makes them particular. It is always something in the facts of the particular case which breeds particular questions of law. Intelligent discussion of any particular question which you might have in your minds, is impossible, therefore, unless the facts on which the questions arise be known. And even then such prejudicial discussions are of slight value, the law not being an exact science, on account of which we may be sure to find its professors differing in every case—one on each side. Their difference will scarcely ever be about what the law in the abstract is, but what is the law of the particular facts in controversy, and Mr. Lincoln was accustomed to distinguish judges from other lawyers, on the sole ground that the judges have the last guess.

The canoeist whom I have referred to would, if seriously desirous that the record of his trip should be interesting, restrict his descriptions as the scene expanded; with the same motive I shall now draw in from the broad topic, Patent Law, which your committee proposed to me, and restrict myself to two topics of that wide subject. (1) What constitutes an invention—which was also specially suggested to me; and (2) what is the true term of a patent for an invention previously patented abroad? These questions arise under Secs. 4,886 and 4,887, of the Revised Statutes, and, therefore, when the first question is disposed of, it is not a long step to where the other lies hidden in a mystery—awful to the interested parties—which may be lifted by the Supreme Court, next Monday.

In respect of the first topic, a limitation must be proposed to bring it within my capacity to understand; we must restrict ourselves to considering what is a patentable invention, under the statute as it stands. Outside of that prosaic limitation, the question is one of psychology, and could not be what constitutes a patentable invention, but what is invention in itself. Here would be an unlimited field, for the cultivation of which I have no competency. In respect of that, I shall have to repeat what was said by one of the numerous claimants of the inventorship of the telephone when pressed to explain the principles on which his great invention operated. He said, "Look a here, Mr. Storrow, I'm no professor; I'm just a practical man." Being just a practical man myself, I can do nothing with speculations whether invention is distinguished from other lesser mental operations by the constant element of imagination. I have been present at the ostensible birth of one great invention, and though it came like a flash across the sky, it was a work of pure reason. This was the phonograph of Mr. Edison. Sir William Thomson said of the telephone that it realized a mathematical conception, and a mathematical conception has but little imagination in it; and the late Mr. Dickerson was in the habit of arguing that Bell, once in the eddy and vortex of his own special knowledge, was swept by a resistless logic to think of the magneto telephone, and of the principle of the famous fifth claim, whether he would or not.

Nor will time permit me to distinguish experiment and inchoate conceptions from invention reduced to practice. Questions of that sort can arise, I think, only between rival inventors, in that scramble for a patent which is dignified as "the race of diligence."

The little I have to say must be within the adjudicated definitions of the courts, and relate only to inventions for which patents have already been granted.

Every invention or discovery of (1) a new or useful art; (2) machine; (3) manufacture or composition of matter; (4) or any new and useful improvement thereof, is patentable, except such as have been (1) known or used by others in this country previous to the date of the invention; (2) or patented or described in any printed publication in this or any other country; (3) or on sale or in public use for more than two years prior to the application for patent; (4) or which can be proved to have been abandoned.

This is a mere paraphrasing of the statute, it is true; but we must begin somewhere. So let it be with a defined, practical idea of invention, made in view of its place in patent law usage rather than in philosophy; in other words "patentable invention."

I will quote the language of the Supreme Court in a case where they held a certain improvement in revenue stamps not patentable.

"As soon as the mischief became apparent, and the remedy was seriously and systematically sought, the present regulation was suggested and adopted, just as a skilled mechanic, witnessing the performance of a machine, by the application of his common knowledge and experience, perceives the reason of the failure and supplies what was obviously wanting. It is but the display of the expected skill of the calling, and involves only the exercise of the ordinary faculties of reasoning upon the material supplied by a special knowledge, and the faculty of manipulation which results from its habitual and intelligent practice; and is in no sense the creative work of that inventive faculty which it is the purpose of the Constitution and the patent laws to encourage and reward." (Hess *v.* Reynolds, 113 U. S., 73.)

In the same case the court said said, denying the patentable quality of the device:

"It does not spring from that intuitive faculty of the mind put forth in the search for new results or new methods, creating what had not before existed, or what had been hidden from vision."

First, the invention must relate to one of the enumerated subjects (for not all inventions are patentable), and must meet the affirmative conditions by being new and useful. With all this it may fail of obtaining or supporting a patent if the negative conditions of being previously unknown in this country, etc., are not complied with.

It must have emerged from the shadowy region of mental gestation, and be capable of such description that one skilled in the art can make or practice it from that description; it must have been legitimately among the royal progeny of inventive thought, not among the brood of good things and notions which hourly spring from the practice of every trade and art. Yet these are merely words, and do not help to make vital distinctions. It is easy to see what is not invention, but no infallible rule is known to me by which to ascertain what is an act of invention, as distinguished from a work of mechanical skill. That is often born in a manger which is destined to rule the fortunes of mankind—and of all great agencies of this sort, the industrial invention has most frequently this humble origin—and it has no mark. Only judicial inquiry in the patent office or the courts can certify it by setting a seal upon it.

And then its title is not clear until it has won its last seal. For instance, I can venture to assure this Club that, contrary to the opinion of counsel on both sides of the question—indeed, there was no question—it is not an act of invention to improve a cabinet creamery in which cans of milk are set by letting the lower half of the can protrude through the bottom of the box and surrounding the upper part with water, as a method of cooling the top of the milk and inducing it to rise and fall in reverse vertical currents, depositing its cream at the top. No experts were asked whether the state of the art precluded the idea of useful novelty in this device. The lawyers made no question that there was invention, and disputed only who it belonged to. Weeks must have been spent in taking proofs on this point. And, finally, out of its inner consciousness, apparently, perhaps of its own lacteal experiences (including the morning coffee compound where it would be nonsense not to have the milk hot), the court determined that there was nothing new and useful in this method of making it cool.

I mention this because it is the last case on the point, and because it is the only one known to me in which both sides were defeated.

True inventions have been recognized judicially in terms of such general import and application, that when they have received sufficient application they may suffice to found some general definition by which a true invention may always be known. I will repeat a few of these, selected without system:

An invention will always produce a new result (93 U S., 486), or an old result in a new way, or an improved way (9 F. R., 293). The better use of known equivalents does not involve invention (103 U. S., 797). It must be useful; but a small degree of utility will suffice if the novelty is clear, and a great degree of utility will float an invention in which the novelty is slight—that is, in which the new part is but a small proportion of the whole, or is but a slight departure from what was known before. There must be more than the mere skill of the mechanic, or the use of better materials in it; and as the skill of mechanics is increasing, so does the degree of the intellectual element of invention require to sustain a patent increase (102 U. S., 112; 112 idem, 244; 31 F. R., 224). An accidental making of a thing, without the power to reproduce it, is neither invention nor discovery, in the legal sense (1 B. & A., 599). To make a machine of iron which has been made of wood, with the sole result of improving its strength and durability, is not invention; but if, being of iron, the machine should, by that fact, have a new application, or should give a superior product, it would be patentable for that new use at least (3 Fish, 103). To render an article salable which was before unsalable, is some evidence of invention (17 Black, 249). The term, as used in law, implies an operation of the mind, resulting in finding out or devising something useful which did not exist before (1 Fish, 252). The last serial number of the United States Supreme Court Reports contains a decision on a patent for a device for opening or closing simultaneously both gates of railway car platforms, consisting of links connecting the gates with rods sliding in or on bearings secured to the guard rails of the platforms, and having handles whereby the attendant standing at the end of such guard rails may open or close the gates. I choose this case as an example, first, because it is the very latest case on the subject, and next because the infringer being the Manhattan Railway Company, every member of the Club can have the opportunity, for five cents, by standing on a crowded platform, to study the case of a non-invention every night and morning. The Supreme Court complimented Judge Wallace, of this circuit, by copying a considerable part of his opinion and adopting it. The principles which he laid down will give the cue to define—sometimes—the line between invention and mechanical skill. He said:

"A brief reference to the prior state of the art will indicate that the combinations referred to in the several claims are merely an application to a new situation of old devices which have been previously applied to analogous uses. Devices to open and close an aperture at a distance from the

operator in a great variety of forms were old. As illustrations of those things which are matters of common knowledge, and of which the court will take judicial notice, it is sufficient to allude to the strap used by the driver at the front of the omnibus to open and close the rear door; to the devices for opening or closing valves at a distance in steam and hydraulic apparatus; and to the devices used at railway switches for opening and closing the rails. Referring to the prior state of the art, as shown by various prior patents which have been introduced in evidence, it appears also that mechanism to open and close the entrance to passenger cars, at a point distant from the operator was likewise old, as where the operator, standing upon the front platform, employed such mechanism to open or close a door at the rear platform. Mechanism for opening and closing apertures distant from the operator, in which the devices used for the purpose are the mechanical equivalents of those employed by the patentee, is shown to be old by a large number of patents which have been but in evidence. This partial exhibit of the prior state of the art demonstrates that what the patentee did was to adapt well-known devices to the special purpose to which he contemplated their application. It was necessary that the gate should swing inward to open and outward to close; that the sliding rod should be located where it would be out of the way of passengers entering or leaving the platform; and that the end or handle of the rod should be located where it could be conveniently operated by the attendant without inconveniencing out-going or in-coming passengers. The new situation required adequate modifications of existing devices for opening and closing an aperture at a distance from the operator, appropriate to the new occasion. Accordingly, the patentee located the rods on bearings secured to the guard rails, with their handles near the passage way formed by the space or opening near the middle of the guard rail. If this required invention, his improvement was the proper subject of a patent. He did nothing more and nothing less than this. It seems impossible to doubt that any competent mechanic, familiar with devices well-known in the state of the art, could have done this readily and successfully upon the mere suggestion of the purpose which it was desirable to effect. The patentee is entitled to the merit of being the first to conceive of the convenience and utility of a gate-opening and closing mechanism which could be operated efficiently by an attendant in the new situation. His right to a patent, however, must rest upon the novelty of the means he contrives to carry his idea into practical application. It rarely happens that old instrumentalities are so perfectly adapted for a use for which they were not originally intended, as not to require any alteration or modification. If these changes involve only the exercise of ordinary mechanical skill, they do not sanction the patent; and in most of the adjudged cases, where it has been held that the application of old devices to a new use was not patentable, there were changes of form, proportion or organization of this character, which were necessary to accommodate them to the new occasion. The present case falls within this category."

A leading case (Penn. R. R. *v.* Locomotive Truck Company, 110 U. S., 490) holds that the application of an old process or machine to a similar or analogous subject, with no change in the manner of applying it, and no result substantially distinct in its nature, will not sustain a patent, even if the new form of result has not before been contemplated. Under that authority it has been held that a mechanical combination for turning skewers or spindles in wood, anticipates a similar combination for cutting sewing machine needles. The application of the combination to one material, naturally suggested its application to the other material, and its being a mere mechanical adaptation, which is not patentable (94 U. S., 187, and 107 U. S., 192). Other practical applications which have been held not patentable, have been: Means for applying steam power to capstans (112 U. S., 224); applicatory to a valve for water cylinders for steam engines (113 U. S., 679); for improvements in street cars (114 U. S., 149); for cheese formers for cider presses (119 U. S., 135); for tools for attaching sheet metal mouldings (139 U. S., 130); for vehicle dashes and dash frames (29 U. S., 142), and, lastly, the railway car gates already spoken of.

The best reflection which I have been able to give to the problem "What is invention?" seems to leave the question for further physiological study, and I doubt if any mere lawyer will ever find it out. It is for a philosopher, and when he propounds the answer, who will understand him? Who shall explain his explanation? I do not refer to that question arising between inventors: "When does an invention pass from the inchoate state of speculation and experiment, and become a full-fledged invention?"

That would open another field which there is not time for.

The condition of usefulness, as a pre-requisite of a patent, is complied with, if the article is useful at all; that is, degrees of usefulness will not be inquired into. That which is mischievous or immoral cannot be useful in a patent sense; and, therefore, a patent would be denied to the most novel and ingenious way of setting fire to houses or robbing banks. The new and useful invention must, however, relate to an art or a machine, manufacture or composition of matter, or an improvement on one or more of these.

An art, in this sense, is a useful way of doing things, which, when done, are useful. This naturally includes all processes. A new method or process for doing useful things, old or new, is patentable as a process. Process has been defined as a mental conception capable of being carried out by any means, new or old, and if the process is new and useful, it is patentable though the product and all the means are old. A leading case on process in this country is Tighlman *v.* Proctor, which case should encourage every beaten inventor and his counsel never to say die, even when certainly dead.

Another is the telephone cases. The Bell patent of 1876 was enforced against infringers, not because they used any device which he had ever thought of, but because the principal or process on which the inculpated device worked, was that on which another device, not in use, and invented by the patentee, was assumed to work. That process being claimed and held to be new; the fact that the apparatus by which alone the patentee had any idea of using it was impracticable, *i. e.*, not useful outside of an experimental laboratory, did not prevent the court from restraining the use of other and practicable machines not invented by Professor Bell. The inventions of Blake, Berliner and Edison, which constitute the telephone transmitter in universal use, could none of them have been used except under license of the owner of Bell's patent, and his impracticable figure 7, and yet he never made a transmitter capable of commercial use.

In the telephone cases reported in 126 U. S., a rule was asked for (page 204) by which to determine when an art is discovered. Having in view certain facts which were assumed and asserted, and believed in respect to the previous experiments of Philip Reis, it became the duty of counsel to urge as a proper answer that:

To conceive that a thing can be done;

To indicate correctly the general laws of nature which must be availed of;

To create suitable apparatus, even though it is suitable in a very limited degree only;

To use the apparatus and succeed, though only in a limited degree;

To publish the result with sufficient specification to reveal the whole purpose and to put the world on further inquiry;

Is a sufficient discovery to take the doing of that special thing out of the category of wholly undiscovered arts, and to defeat broad claims by subsequent inventors of mere apparatus.

From that state in the development of that art, I urged conscientiously that invention and discovery must be limited to the perfecting of old or the invention of new mechanism, by which to practice the previously discovered art. The court did not think the facts of the case supported by hypothesis, and the reasoning, therefore, did not prevail; but this does not impeach its correctness, considered abstractly or in relation to any simple basis of fact. I should say, therefore, notwithstanding the decision in the telephone cases, that a new art may be sufficiently discovered independently of any good mechanism for practicing it, to defeat from that time the allowance of broad claims for any process, to the subsequent maker of good apparatus.

The word "machine" includes every mechanical device or combination thereof, or of mechanical powers and devices to perform work. It is said there can be no patent for a mode of operation exhibited by a machine; but this must mean where the mode of operation results from the machine, and not where the machine is contrived to carry out a process previously conceived, especially if various constructions are adaptable to operate the process. A process is said to be a mode of treating materials to produce a given result, and the machinery pointed out as suitable to perform the process, may or may not be new and patentable. Of course, every process which depends on a machine is, in a sense, the function of that machine; as, on the other hand, every machine is an embodied function of some sort. I think a short way for determining the patentability of claims for such processes, might be to inquire the object of the inventor and the progress of his idea; did he make a machine and stumble on its functions, or did he conceive a function and labor to devise a machine capable to execute it. In the one case he begins with a conception of the mind and proceeds to a work of the hands. In the other he perfects a work, and then, watching to see what it will do, claims its functions as a process, in order to prevent by a broad claim other men from making different machines to attain the same object. Mechanical processes are, therefore, held to be not patentable, being merely the inevitable way the thing works. There does not seem to be any infallible or universal rule for distinguishing those purely mechanical processes, born from a machine rather than from the brain of its inventor, from those other functional processes, which, together with their connected apparatus, is held to be patentable. It appears to me, however, that the unpatentable process will most generally be the final thing resulting from the machine's operation; and that the patentable process will be found to be an intermediate function to produce a final process. Thus we say "that a board is undergoing the process of being planed, or grain of being ground, or iron of being hammered or rolled." (Corning *v.* Burden, 15 How., 268.) Here the term is used passively or subjectively, as applied to the material operated upon, and not to the method or mode of producing that operation, which is by mechanical means as distinguished from a process. In this use of the term, said the Court in Corning *v.* Burden, it represents the function of the machine. That function, for instance, grinding of grain, is non-patentable. But the case of the Bell telephone is clearly different. There a process was held patentable, but, upon examination, we find that it was an intermediate process, which was not the function of a machine, but which has itself a function which is the final object of the whole operation; to wit, the reproduction, in one place, of sounds made at another place. The machine is composed of the transmitting and receiving mechanisms, the batteries and the connecting wire. The first, and patentable process, is the creation of electrical undulations of current strength on the wire, similar in form to air vibrations, accompanying and constituting sound. The secondary process is the reproduction of those sounds. No court would sustain a simple claim for the transmission or reproduction of sounds telegraphically, which is the final process. But they have thus far unanimously sustained the claim for that process when carried on by the primary process of "causing electrical undulations similar in form to the vibrations of the air accompanying the sound."

It was not my intention to make any reference to proceedings in the Patent Office, having no special familiarity with them, and the subject being too extended in itself to have any place in this brief address. But in the number of the Official Gazette for February 18, I find a decision which definitely settles an important question in such a manner that it may be convenient for many here to know of it.

A rule of the Patent Office requires that separate inventions should receive separate patents. This resulted, during the late administration, in a decision that an invention of an apparatus and process being separate inventions, and must be separately applied for. It was not denied that a patent for both process and apparatus was good, for that was just the sort of patent which Mr. Bell got, but it was said that the Patent Office would not allow any more such. The inconvenience resulting from that decision seems to be cured by a case just decided by the present very intelligent and judicious Commissioner of Patents, reported in the last number of the Gazette.

Substantially it is now settled that, although a process and apparatus for carrying out the process are separate inventions, they are not necessarily *independent* within the meaning of the forty-first rule of the Patent Office; and, when they are dependent on each other and mutually contribute to produce a single result, they may be joined in one application.

Under the head of "any new and useful improvement," we have had many interesting questions, from which, in the briefest manner, I deduce a few principles. A union of old mechanical parts in a new combination to produce a new and improved result, which is not a mere aggregation of the old results of the respective parts in an improvement. In a patentable combination of old parts, the constituents must qualify each other, so as to form a new machine of different character or function, or one producing a result due to the joint or co-operative action of all the constituents, which is not a mere adding together of separate contributors (104 U. S., 310; 26 F. R., 153).

The negative conditions of not being known by others, etc., of non-publication and of non-abandonment, must be treated in a passive way. The most interesting novelty under the first is a recent decision by the Commissioner of Patents (Official Gazette), from which it appears that a foreign inventor may, prior to application for a patent here, communicate a description to some person resident here, and that will enable him to defeat applications by others for inventions subsequent in date to his communication for the same invention. I have always regarded that as a favorable means by which a foreigner may prevent forestalling by those who, seeing his invention abroad, might claim it here, relying that, in an interference, he could not name any date of invention earlier than that of his foreign patent.

The other negative conditions, of non-use and abandonment, I must pass without remark. Without any desire to be facetious, I am compelled, on the whole, to say that the only safe answer to the question, "What is a patentable invention?" is that "it is an invention for which a patent can be got and kept."

III.

Let us assume now that the patent is issued. The next thing of interest is: "How long will the granted monopoly last? What legal rights will it confer, and what, if any, causes may affect it during the term for which it is granted?" These questions arise partly under the provisions of Secs. 4,886 and 4,887, of the Revised Statutes, and to those sections I shall limit myself, as follows:

SEC. 4,886: Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country before his invention and discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law and other due proceedings had, obtain a patent therefor.

SEC. 4,887: No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent be declared invalid by reason of its having been first patented or caused to be patented in a foreign country, unless the same has been introduced into public use in the United States for more than two years prior to the application. But every patent granted for an invention which has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or if there be more than one at the same time, with the one having the shortest term, and in no case shall it be in force more than 17 years.

The original granted term is 17 years, unless the invention has been previously patented abroad, in which case, that term will be limited to the term of any foreign patent then existing. This limitation defies justification or excuse. It exists in most foreign patent codes or systems, and was formerly in the English system. The wise revision given in 1883 by the British Parliament to the whole subject, resulted, among other things, in its complete abandonment in the present Act 46-47 Vic. In our system, as in all foreign systems, it is imitated from the old and now abrogated English model, without, as I assume, any intelligent consideration of its motive or effect. The reason generally suggested is that State policy forbids domestic restrictions on the right to make a thing which is without restriction elsewhere. But this reason is manifestly too broad, for it includes all States in its purview, whether patents have been previously granted or not; whereas our Act regards only those States where the manufacture having been once restricted has become free during the currency of a like patent here. The reason must, therefore, be narrowed to fit the case, and not overlap.

Now, no person can suggest a real, as distinguished from a merely formal and perfunctory, reason why the expiration of a prior foreign patent should end a domestic patent, which would not be equally applicable to the case where the foreign patent is not prior but subsequent; or to the case where there has never been foreign patents. If the motive is to make that free here which is free elsewhere, then the history of the foreign freedom—whether it has always pertained to the subject or has once been granted away and afterwards recovered—is immaterial. If the existence of a monopoly abroad is in any case a reasonable condition of monopoly here, it is indifferent whether the absence of such foreign monopoly is due to its having been ended, or to its having never begun. If it ought to end here when it ends there, *pari ratione*, it should not begin or continue here unless it also begins or continues there.

But, indeed, there is no such reason. What public or private end needs such a provision? Certainly none but the sporadic and unavoidable interest of those who like to see another drop something that they may pick it up. In what—adopting the narrowest and most selfish maxims for our guidance—is the American people injured if the Spanish people enjoy freely an article on which we must pay royalty? The patented article cannot be introduced here while the patent survives, however cheaply it may be made. Its cheaper product is kept out by a barrier more lasting than a patent term—protective tariff interest.

I can conceive of but one really useful result from what I say to you to-night—it is to induce every member to seek a repeal of Sec. 4,887, so far, at least, as relates to patents hereafter to be granted.

The history of the troubles of inventors under this section shows that the question first arose in a case where an English patent for 14 years had expired and was afterwards

re-instated. It being prior in date to an American patent for the same invention, the court held that when the 14-year term of the English patent expired, the American patent expired, and that the English re-instatement could have no effect to revive the dead American one. That case was followed by a short series of cases arising under a different state of foreign law, to wit, Canadian patents issued under the peculiar terms of the Dominion statute, for five years, with a privilege of renewal for two succeeding terms of five years each. In the circuit courts these cases were deemed to be like the English one, although grace and favor, which was the legal basis of one, and legal right of the other. Finally, this question reached the Supreme Court, in the noted case of Bate *v.* Hammond. The Supreme Court in that case decided that a Canadian patent which carries with it a right in the inventor to take the successive five-year terms without consulting any one, is virtually a 15-year patent from the beginning. But this natural and logical result did not take cases arising under Sec. 4,887 out of the woods. On the contrary, some expressions in it have brought doubt upon another class of cases, in which the foreign patents come to an end, not by the expiration of their original terms, but by failure to pay taxes or perform some other continuing condition called by lawyers conditions subsequent. That question is now before the Supreme Court in a case submitted within a few days past, and decision may be looked for soon. I shall not repeat to you the arguments. Suffice it to say that the interpretation which I hope will prevail in the Supreme Court is that the only conceivable motive for limiting the American term, by reference at the time of the issue to foreign terms, is that certainty may be attained in the beginning as to the duration of the American patent. It is necessary that buyers, sellers, licensees, infringers and the whole public should, at all times, be able to learn just how long a patent has to run. This certainly *is* attained if the term of the foreign patent then in existence is definitely adopted as the measure. Under that condition we have an unchangeable record to go to to ascertain how long the American patent was issued to run. I have said I shall not repeat the argument in this case; but I may call your attention to some of the incongruities and absurdities and possible oppressions which may result from a contrary decision. To stimulate every inventor to use his influence with Congress to have the section repealed, I will mention a few instances in which that interpretation would have results so contrary to all that is reasonable as to create doubt as to whether Congress intended it. After the decision of Bate *v.* Hammond, a defendant amended its answer in a suit brought against it by the Edison Company, by setting up the fact that the Canadian Edison patent for a lamp, composed of a filamentary carbon of high resistance, in a glass globe hermetically sealed, etc., had been put an end to by the proper functionary at Ottawa, on the ground that the invention had been imported contrary to law and had not been manufactured in Canada as required by law. It was true that such judgment had been rendered and the Edison patent declared void. Had the American case then come to trial, the Circuit Court must have decided (under a decision rendered last summer in a beer-cask case, where breach of the condition subsequent to pay taxes was held to have terminated an American patent) that the Edison filament patent would have come to an end here. This would have been a very serious consequence, I think, to its owners; but since that time the case against the Canadian patent has been re-heard and decided exactly the other way, so that it now appears the Canadian patent has not come to an end, but remains in force. Suppose a final decision against the United States patent had been rendered before this re-hearing and correction of error in Canada, that subsequent correction of its errors by the Canadian tribunal would have no effect to revive the lost American patent. The false rumor of its Canadian death would have killed, but a revelation of the truth could never have restored it. In an old sea song the false and married sweetheart attempts to excuse her treason to the returning sailor, and says:

"For somebody came to me and said,
"That somebody else had somewhere read,
"In some newspaper, John, as how you were dead."
"Dead, dame, I haint been dead at all," says Jack Robinson.

But conceive the humiliation which every honest mind would feel if, by operation of law, a great property should actually and irrevokably fail on a mere false rumor, which is substantially all there was of the original Canadian judgment; for, upon examination, it turned out that the person who professed to decide the first hearing had no legal authority, and upon the examination by the functionary who had, it turned out there were no such facts as the first officer relied on.

But other possibilities, equally monstrous, result from the provisions of foreign laws. In many foreign countries patents are terminated for the doing of things which the policy of our law expressly approves. For instance, in England, prior publication rendered a patent void. Consider the effect of this in the case of Mr. Bell. When he filed his principal application, in 1876, and simultaneously sent an application to Great Britain. He was put in interference here with Gray. You all know the delays which may thus result. The interference was vacated. But suppose it had not been, and the customary delays had occurred, so that the English patent had issued first. In the meantime Bell gave to Sir William Thomson one of his telephones to take home. Sir William in some way bent the diaphragm on the journey, and, being unfamiliar with the instrument, did not restore it. He produced it in that condition before the British Association. Of course, it did not talk. When the English patent was sued upon, it was set upon as a defence that this prior exhibition rendered the patent invalid. But the plaintiff succeeded, on the ground that a telephone with a bent diaphragm was not Bell's telephone. Now, we have only to supply two accidents, viz., that Gray's interference had been retained sufficiently long, and that Sir William had thought to restore the bent diaphragm, and we should have seen the original Bell patent lost in England for a prior publication which would have been innocent here, and then lost here, because it had been lost there.

Can it be supposed that Congress means to punish an American inventor because some stranger does that in England which is perfectly innocent here? Yet that is what the present state of our laws, as interpreted in the beer barrel case, implies.

I will mention another possible case. In Peru, the law allows any person who considers himself interested, to demand the nullity or cessation of a patent. All patents are to be declared null if they are not new. Peruvian law delares a "new invention" as one which has not, previous to the Peruvian application, had anywhere sufficient publicity to put it into practice. Now, our laws allow two years public use before application for a patent. Suppose an American inventor, first putting his patent in the allowed and encouraged public use of two years, then applying for a patent here and incurring the not unusual delay, then going to Peru, and by reason of the greater administrative promptness, obtaining a patent there before his application is acted on here. The Peruvian patent being out, and the American patent being out, but of later date, any one in Peru who deemed himself interested, might bring suit to set aside the Peruvian patent, because the United States two years public use constituted—as of course it would—"sufficient publicity in the United States to put it into practice," according to Peruvian law. On this, the Peruvian patent would be declared null—which is their affair—and then the American patent would have to be declared null, substantially for the public use in the United States, authorized by law. Thus you see how a man can get himself punished in his own country for a lawful act.

These illustrations could be numerously repeated. Take the case of Austria. Austrian patents are annulled when granted on foreign inventions, which are not at the time patented in the place of their origin. From this it might result that an American inventor, applying here first and afterwards in Austria, and, from circumstances beyond his control, obtaining the Austrian patent first, should have it taken away because being unable to get his own office to act in time, he had not patented the invention in his own country first; and, thereupon, he at once would be liable to lose his American patent subsequently obtained, as a proper punishment for having lost the prior Austrian one.

Among the numerous patent laws of the world—something more than 50—the continuance of patents is predicated on some very absurd conditions subsequent. In one British colony the patentee is required to supply to Her Majesty's officers the patented article at such times, and at, and upon such reasonable prices and terms as shall be settled for that purpose by the governor. Now I am not going into the question whether this does not mean patented articles for Her Majesty's use. We know how easily this sort of thing is arranged, and how many things are supplied ostensibly for public use, which really go to the comfort and convenience of public servants. But conceive of it; because a petty functionary of British Guinea chooses to set the price of a patented hair-oil, or pipe-claying material, at a figure at which it could not be supplied, the provincial patent shall be annulled, bringing with it as the vast consequence of a trivial cause, the loss of a great American property.

There is reason in all things, and this section which I have been criticising is capable of being read with reason; and so read and interpreted, it is less offensive to public and private interests. It is my hope that during this term the Supreme Court will establish that reading.

Under the head of what things may terminate the efficiency of a patent, of course it would have been right, first to speak of the expiration of its natural term, but that goes without saying. It also goes without saying that although a patent does not come to an end, its usefulness may cease by its claims being declared by the courts null and void, for want of novelty, etc.

There is also another case which has lately been brought before the Supreme Court—that in which the government itself demands the annulment of a patent whose issue had been obtained by fraud. That such a jurisdiction exists was disputed, but has been finally established in a notable case, leaving the question of fact whether there was any fraud for subsequent determination.

THE DISCUSSION.

The Chairman: Following the papers which have been read at the meetings of this Club, discussions are in order, and I would say that there is no precedent of the Club which limits the length of this discussion. I would say that after the discussion is over, lunch will be served in the dining room, and, in connection with the lunch, an article which is a work partly of mechanical skill and partly of invention, which is known as the "Electric Punch." There are no possible objections to it if it is taken, in the words of the learned speaker, with "due regard to condition subsequent." (Laughter.)

Mr. E. P. Thompson: If a certain precaution, and time and expense, is gone into soon enough, the foreign patents may all issue on the same day, and then they may continue to last a certain number of years which can be protected. If the patents be taken out in Russia, and in one or two other countries where the term is comparatively short, those can be applied for a little later, without doing any harm to any of the patents, but in all countries where the terms are substantially the same as the United States term, all these difficulties can be overcome by taking certain precautions and making arrangements to have all of the patents issued on the same day. The courts in their decisions are not guided by previous decisions as is the patent office. They make the decision just what they please, but in the patent office everything is done by rule, and the operation of the different departments is very similar to working out a mathematical problem. If a certain application is rejected, it is rejected on account of some decision and you cannot overcome that unless you can argue that another decision is in the nature of an additional argument which will overcome the decision which has been referred to. Very often cases are rejected on the claim of aggregation. If the patent office know it is nothing but aggregation, it is proper for them to reject it upon aggregation. Then, it is the place of the attorney to show that it may be something else. I have compiled the decisions in a very brief form, to be referred to, and have found them very useful in determining patentability—in determining what we may call those rules. In the electrical field we know that they determine certain things by certain forms, also by principles in science. In electricity we have terms familiar to us all, amperes, volts, ohms, and those are perfectly familiar to all electricians. And so in the patent practice before the patent office, it is found that there are certain terms there that are familiar, like novelty, new and useful results, usefulness, improved old result, useful result, old elements combined, duplication of parts, substitution of new or equivalent elements. (The speaker here presented a tabulated statement.)

Mr. Curtis: I hope everybody here will appreciate as well as I do how much we are indebted to Mr. Lowrey for his lecture this evening, remarkable in its wonderful perspicacity, and for the fact that he gives us the observations of one of our most learned and well balanced legal minds. There is one subject that he dwelt upon mostly, the question of what constitutes patentability—what constitutes an invention—which seems to me is susceptible of a little less pessimistic view. Mr. Lowrey is probably much more familiar than I am with the point I am going to mention. The tests of what constitute patentability which have been given by the Supreme Court, are based upon the hypothesis that there is in the mind an instructive faculty, a faculty of producing an invention by creating something that did not exist before. These are very unsatisfactory. Some of the most common tests that the Supreme Court applies is whether it had prior invention, whether there was any ingenuity, whether the inventor exercised the intuitive faculty, whether it has a double use, whether the invention was obvious or not. Of course, all such inquiries are entirely futile and unsatisfactory. To the mind of an inventor like Mr. Edison, what would appear to be the most obvious thing in the world, would be the most difficult and impossible to invent for most of the judges of the Supreme Court, so that no two men can be expected to agree as to whether it was obvious or not. I think it was first proposed as much as 20 or 30 years ago—a test of what constitutes an invention, which has very much more logic in it, though it perhaps is as difficult to apply as any other test which has ever been suggested, that is, whether the elements stated in the claim to constitute the invention, co-operate, have a joint action to produce a new result. In probably 98 cases out of 100, that test could be applied and applied intelligibly, and it is possible to arrive at a satisfactory result in that way. That is the test that the Patent Office has been applying and whenever they are able to apply it satisfactorily they generally decide questions of patentability in that way. Of course, there are instances of combinations where it seems perfectly impossible to decide whether there is a new result arising from a peculiar co-operation of the elements. As an example of the difficulty of how difficult it is to apply that test, I attempted once to obtain a patent for an electric fire extinguisher, a combination of a motor pump on a wheel. I invented all the arguments I could to make out some due co-operation of the elements, among other things, that the motor being supplied by power from another source, and carried forward by the wheel, was operated differently in that respect, and served to make an engine pump of a given power that was very much lighter. The patent office fought that for a long time, and finally they virtually admitted the patent ability of it. I am now, myself, rather inclined to the other side. They admitted it, but the patent was never issued, because they suddenly discovered that in the same room in the patent office there had been issued by the same examiner, another patent for exactly that thing. (Laughter.) That was after the case had been argued in the courts for two years. One of the most remarkable patents ever issued by the patent office, is for what a man calls an indentifying box, consisting simply of a box to attach to the necks of cows to identify them. That was seriously patented as an identifying box. (Laughter.)

Mr. Sewall: There is no doubt that the man with his documents and his patent sustained, has something that is an invention. (Laughter.) I think we can all say amen to that. But I think, in view of the numerous decisions made by the courts, some one way and some another, we may say that in patent matters, above all other questions, there is room for the exercise of the greatest amount of common sense. You have to find out whether a thing is new, whether it is useful, and exercise good common sense in making others understand that same thing as to the novelty and utility. Many patents have been defeated before the courts, because the question has not been presented with sufficient common sense to enable the court to understand the questions of novelty and utility. I am well satisfied that the most important thing for an inventor, and to be urged on examiners in the patent office, and upon the commissioner and everybody concerned in patents, is the exercise of common sense in getting up an invention that is useful. Another point which Mr. Lowry did not refer to regarding section 4,887. This was intended to prevent a foreigner from coming here and obtaining a patent which would run longer in this country than it did in his own country. I have urged for years, and I wish the profession would join in it, that where a man residing here applies for his patent in this country before he applies for his patent abroad, no matter when that patent is subsequently granted, it should be granted for the term of 17 years. Thereby, when a man in this country presents his application, he is not responsible for the delays in the patent office, and he should not be punished because he goes abroad and takes a patent. The profession should join in urging Congress to enact in connection with 4,887, that this section shall not apply upon any patent granted upon an application for the United States, before a foreign patent is granted.

Mr. Phelps: Mr. Lowrey has cleared up our ideas to a very large extent in respect to many questions, and he has given us a good deal of positive information and an uncommon amount of pleasure. The next best thing to positive information is giving us negative information—that is, telling us frankly what he don't know, and in that particular we have had an additional pleasure in finding that somebody else far better equipped and acquainted with a topic than ourselves, does not know the same things that we do not know. I think that Mr. Lowrey's animadversions on section 4,887 will meet the cordial approval of all persons in the Electric Club, and I hope the Club will not forget Mr. Lowrey's suggestion that, so far as it lies in their power, they will cast their weight in favor of the abrogation of that section. Inventors and electricians, however, with all the drawbacks of the patent system, including those Mr. Lowrey refers to, have had a pretty comfortable time under it.

But there are other classes who need similar protection. The authors and printers are agitating that subject with some prospect of success. I have a resolution here

(*Continued on page* 14.)

KINDRED INTERESTS

The E. S. Greeley & Company.—This company is particularly busy in its electrical department. The large house on Dey street is one of the busiest electrical establishments in the city.

The Eureka Tempered Copper Company, successors to the Anti-Friction Metal Company, of North East, Pa., have issued a neat little circular, setting forth the merits of their tempered copper products, which are guaranteed to wear three times as long as any brass or bronze.

The Manhattan Electrical Supply Co., 26 Church street, New York city, have issued a neat and comprehensive catalogue of their goods for 1890. Many new cuts furnish good ideas of their large stock of electrical supplies, which includes everything from "acids" to "zincs."

Cassidy & Son Manufacturing Company.—This company is now established in its new building on West Twenty-third street, New York. The building extends through from 133-135 West Twenty-third street, to 124-128 West Twenty-fourth street. Handsome exhibit parlors are fitted up with the various artistic designs of this company, comprising gas, electric and combination fixtures, as well as numerous designs in fine brass work, bronzes and clocks. The company is to be congratulated on securing such convenient quarters in such a desirable location.

The Detroit Electrical Company has absorbed the National Traction Company and increased its capital stock to $250,000, of which $200,000 is paid in. The works, which are now at the corner of Woodbridge and Seventh streets, will be moved to more commodious quarters to accommodate the proposed expansion of business. The officers of the consolidated company are: Hugh McMillan, president; W. A. Jackson, vice-president; W. H. Wells, secretary, and John G. Rumney, treasurer and manager. These officers and Levi Barbour, Cornelius Corbett, C. E. Warner, Frank E. Snow and Fremont Woodruff, comprise the board of directors. The company is now equipping an electric street railway at Saginaw, and making experiments with a view to supplying motors for the cars of the Detroit City Railway Company.

Westinghouse, Church, Kerr & Co., five years ago, established themselves as engineers in New York, occupying a small office on the fifth floor. Their business at that time was confined almost wholly to the handling of the Westinghouse Standard engine. They were immediately successful from the first, and were soon obliged to find enlarged accommodations at 17 Cortlandt street. This office occupies the entire first floor of the building, and is handsomely fitted up as the headquarters of the company.

The development of the Westinghouse Junior and Compound engines has greatly increased their business, and from time to time other engineering specialties have been approved and purchased by them, forming a large item in their business. They confine themselves wholly to the generation and distribution of steam power, in which department their experience has perhaps been as extended as that of any other concern in the country.

The continuous growth of their business has required the successive establishing of branch offices, first in Pittsburgh and Philadelphia, and later in Boston and Chicago. The office at Chicago is conducted independently of the New York office, and has been equally successful. St. Louis has always been an objective point, about which most of the Western trade develops, and on the first of January, 1890, Westinghouse, Church, Kerr & Co., opened their fifth branch office at 511 North Fourth street, St. Louis, from which office the Southwestern business will hereafter be handled. The Chicago and St. Louis offices are now controlling all the trade throughout the West and Southwest, to the Rocky Mountains.

The development of a business of this magnitude on conservative principles and by steady growth is a good evidence of what can still be done on the lines of old-fashioned business ideas judiciously mingled with enterprise and responsibility.

"PATENT LAW."

(Concluded.)

which I would be pleased to offer, if in order.

"*Resolved*, That the Electric Club, of New York is in hearty sympathy with the effort of American authors, publishers, employing printers and workmen in the printing trades, to obtain from Congress a just recognition of the rights of intellectual property, and we hail with satisfaction the prospect of an early passage of the International Copyright Bill."

I think we will be pleased to hear from Mr. Johnson, who is thoroughly familiar with that measure.

Mr. Phelps' resolution was duly seconded and carried.

Robert Underwood Johnson (Associate Editor of the *Century* and Secretary of the American Copyright League):

The authors in this country have always held that the copyright question was one which should not be left to them; that it was a question of national interest, of the welfare of our country, not merely one of dollars and cents—whether the American author should receive a little more or a little less—but a question of the actual tone of the literature of this country. Whatever may be the drawbacks and the difficulties which are encountered by inventors, they have been able, under certain conditions, to obtain a due reward, at least a *measure* of protection, at the hands of our government; I mean both reciprocally for their own inventions abroad in foreign countries, and also the inventions of foreigners in our own country. Had the same policy been pursued with reference to authorship, I think, we may say, we should have had in our literature a similar condition of prosperity. As it is, it must be confessed with considerable shame, a shame which, I think, is the shame of the whole country, that the development of our literature has been very far behind the development of the mechanical or material resources of the country. Mr. Lowrey has referred to the announcement which has been made by the Count de Keratry in regard to the state of feeling in France relative to the question of retaliation in case the copyright bill should not pass. Our sins against France have been especially grievous and long continued, in the matter of copyright. We have not only taken without compensation French intellectual products, but we have often mutilated them. Not only has that been the experience of Frenchmen, but it has been our experience in other countries. I recall a popular novel in which reference was made to the President of the United States, which was altered by the English pirate by the substitution of the name of the Queen for that of the President, and the drawing-room of her Majesty for the President's annual reception on New Year's day. I shall merely say a few words in regard to the provisions of the present bill, for in my opinion the present bill is the only bill that can now be passed. It is the only bill upon which we have succeeded in uniting all the interests which are touched by the operation of such a law. The authors are almost to a man, in favor of this bill. The publishers and employing printers, at the annual convention of the Typothetæ, in St. Louis, in August, warmly endorsed the bill after a full discussion. The printers' unions are all in favor of this bill, and it has been arrived at by concessions by the different interests, with the view to doing away with this standing disgrace to our country. The present bill provides for the excision of the word "citizen," by which in the year, I think, 1819, the constitutional provision was limited by statute. It seems that statutes have been the great enemies of authorship. The common law of England gave authors rights in their productions. The statute of Queen Anne, which was intended merely to confer a remedy at law against literary piracy, was afterward construed against the judgment of so eminent a jurist as Lord Mansfield, to have limited the right from a common law right to a statute right. Our constitution made no such limitations, but the statute of 1819 did, and, to-day, the literary profession which the constitution has broadly authorized Congress to promote and for which a special statute was passed, is the prey of the very legislation which was passed for its own benefit. If we had excluded foreigners from the operation of our law, and then had built a Chinese wall about our country, whatever our literature would have been, it would have been our own. As it was, we made such enormous loopholes in this wall that all the foreign literature came in in pirated form, and we find ourselves as a nation more familiar with the institutions of England and France (including not a few alien ideas which America was founded to get rid of) than with the traditions and history of our own country. Your action to-night in regard to this measure will be of great assistance to us, all the more because it is taken in sight of the fact that there is danger that if the copyright bill is not passed, retaliatory measures may be taken by France. I discussed this question with the Count de Karatry, last November and December, when he was here as the agent of the Literary, Scientific and Inventive Societies of France. He has since returned to France with the special object of making a study of public sentiment there, and he now assures me that while the feeling has never yet taken official form and cannot be regarded, as far as the government is concerned, as a threat (though for that matter menace is the weapon of diplomacy), yet there is a growing sentiment in influential quarters that if the copyright bill should fail, the result may be the withdrawal of France from the Berne Conference for the protection of Industrial Property, that is, of patents, into which our government entered, although we declined to enter into a similar convention for the protection of literary property.

There is very little more to say, except to report the favorable progress made with this bill. It was referred in the Senate to the Patents Committee, and by the Committee favorably referred back to the Senate. In the House it was first referred to the Judiciary Committee. Mr. Simonds, of the Patents Committee, thought it was a matter properly within their province, and an almost identical bill was introduced and referred to their Committee. It has recently been reported to the House unanimously from both Committees favorably, two or three members in each Committee retaining the right to offer amendments on the floor of the House. In case they should feel inclined to do so, a usual proceeding when a man is in doubt about a measure. The result will be that we shall have two large committees of men who are educated in the principles of this bill, who will be able to defend it before the House. I, therefore, think I may promise you that with the active support of our friends we shall soon be able to announce the passage by the House of Representatives of this important and valuable measure, and, as we feel very certain that the Senate will follow the House, thus we shall soon be able to extinguish a blot in our escutcheon which has been there for 50 years, to the disgrace of the whole country. (Applause.)

Deafness and the Telephone.

At a recent meeting of the Academy of Medicine, Cincinnati, Dr. Francis Dowling read an interesting paper on "The Causes and Treatment of Deafness." He stated that between the ages of 10 and 40, at least one person in three is subject to a partial deafness. The great majority of cases of impaired hearing date from childhood and its diseases. Another prolific cause was colds and carelessness in bathing. At least one-fifth of the cases of impaired hearing are hereditary, and are largely owing to a too close consanguinity of the parents. Deafness is more prevalent among males than among females, owing to the fact that the male is more exposed to the vicissitudes of climate. There is much more deafness in America than in Europe, and this the doctor attributes to a more general use of scientific instruments, such as telephones, where one ear is used, to the exclusion of the other. He cited a number of cases where he had examined telephone operators, and he generally found the right ear the weaker organ, as it was used almost entirely in telephonic communication. A remedy was to use both ears. Either have two audiphones or alternate the ears.

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TO THE EDITOR OF ELECTRICAL REVIEW:

MY DEAR SIR: In your issue of February 15th, we notice an article headed "Doyle's Motor Switch," which is descriptive of an Automatic Motor Starting Switch, the invention of Mr. Charles B. Doyle, of Chicago. Please be kind enough to inform your subscribers that the claims and objects of this Switch are covered by letters patent of the United States, issued to G. H. Whittingham, in January, 1889, and January, 1890, and now owned by this Company, and that the use of the said "Doyle Motor Switch" will render them liable to suit for damages. The inventor, Mr. Doyle, doubtless does not know of our patents. We invite an investigation on his part, and will afford him all necessary information if he will place himself in communication with us.

We would not thus encroach upon your time and space, but believe it a duty we owe to your subscribers and Mr. Doyle, as well as ourselves. Very respectfully, etc.,

AUTOMATIC SWITCH CO.,
WM. T. MORGAN, Sec. and Treas.

Baltimore, Md., Feb. 25, 1890.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 25, 1889.

421,887 Electrically propelled vehicle; James Adair, New York, N. Y.

421,916 Secondary battery plate; Justus B. Entz and William A. Phillips, Schenectady, assignors to said Justus B. Entz and Montgomery Waddell, New York, N. Y.

421,967 Dynamo electric machine; Mathias Pfatischer, Philadelphia, Pa., assignor to Electrical Accumulator Company, of New York.

421,968 Electric conductor; Eugene F. Phillips, Providence, R. I.

422,058 Electric connector; Charles McIntire, Newark, N. J.; Charles H. McIntire, administrator of said Charles McIntire, deceased.

422,072 422,073 422,074 Telegraphy; Thomas A. Edison, Menlo Park, N. J.

422,082 Telephone line vibrator; Hermon W. Ladd, Boston, Mass.

422,096 Device for suspending electric conductors at crossings; Sidney H. Short, Cleveland, Ohio.

422,147 Electric switch; William E. Parker and Harry E. Temple, Buffalo, N. Y., assignor of one-half to Henry H. Humphrey, same place.

422,148 Dynamo electric machine, or electric motor. 422,149 Electric motor; Edward B. Parkhurst, Woburn, Mass., assignor to the Florence Motor Company, of Maine.

422,174 Grinding electrodes for microphones; Samuel H. Bartlett and Henry E. Waite, New York, N. Y., assignors to the Waite & Bartlett Manufacturing Company, same place.

422,190 Method of electrically heating bars, etc., for welding and working purposes; Mark U. Dewey, Syracuse, N. Y., assignor to Dewey Corporation, same place.

422,196 Electric lighting device; Ellsworth E. Flora and Philo R. Hoy, Chicago, Ill.

422,201 Electrical apparatus for driving artesian wells; George G. Fryer, Philadelphia, Pa.

422,216 William B. Hollingshead, Bronxville, assignor of one-half to Sidney H. Carney, New York, N. Y.

422,244 Switch box; Mark R. Muckle, Jr., and Thomas C. Smith, Philadelphia, assignors to themselves and John S. Muckle, same place.

422,265 Carbon commutator-brush and holder. 422,266 Electric railway motor car; Charles J. Van Depoele, Lynn, Mass.

422,300 Electrode for storage batteries. 422,301 Electrode for secondary batteries; Charles J. Hartman, Summit, N. J.

422,302 Carbon for electric lamps; Henry H. Head, Dublin, and Llewellyn Saunderson, Kingstown, County of Dublin, Ireland, said Head assignor to said Saunderson.

422,308 Electrode for secondary batteries; Farnham H. Lyte, London, Eng., assignor to Electric Car Company of America, of Philadelphia, Pa.

422,339 Electric car motor; Isaiah H. Farnham, Malden, assignor of two-thirds to Geo. Willis Pierce, Boston, and Albert P. Sawyer, Newburyport, Mass.

422,354 Safety cut-out; Frank B. Rae, Detroit, Mich.

422,360 Incandescent lamp socket; William F. Wallin and Elmer H. Worline, York, Pa., assignors of one-half to Amos E. Rieker, same place.

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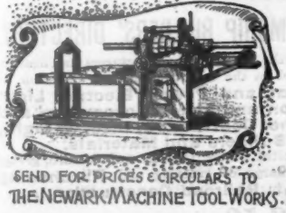

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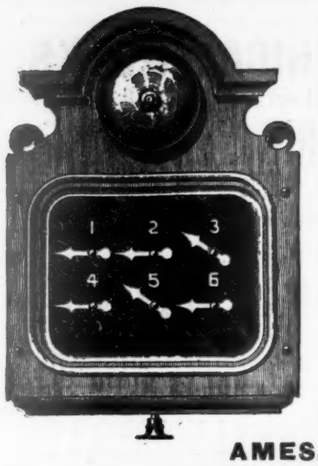

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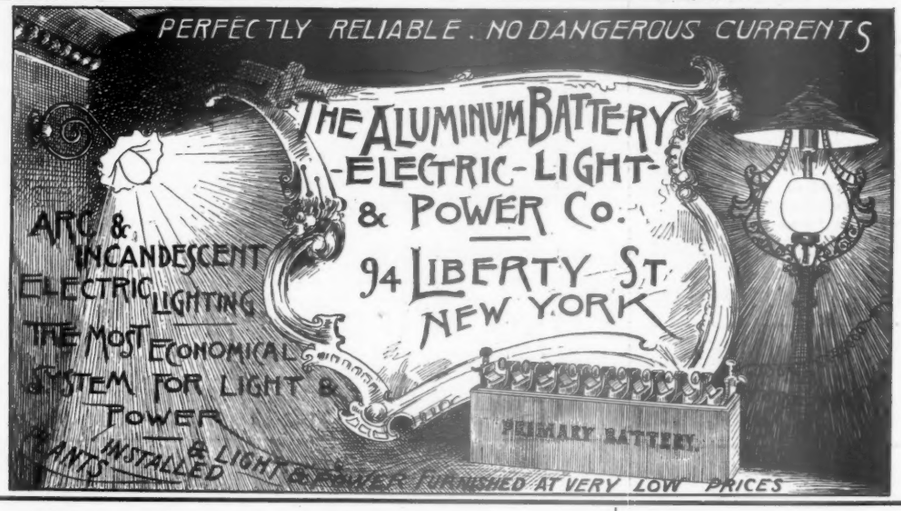
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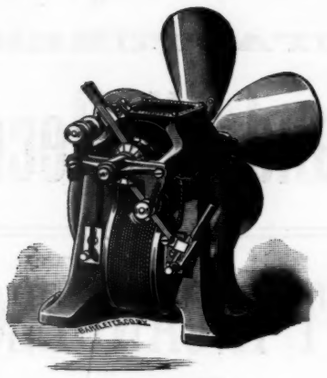

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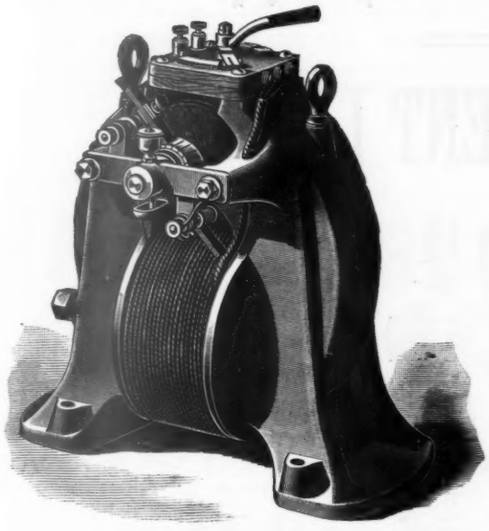

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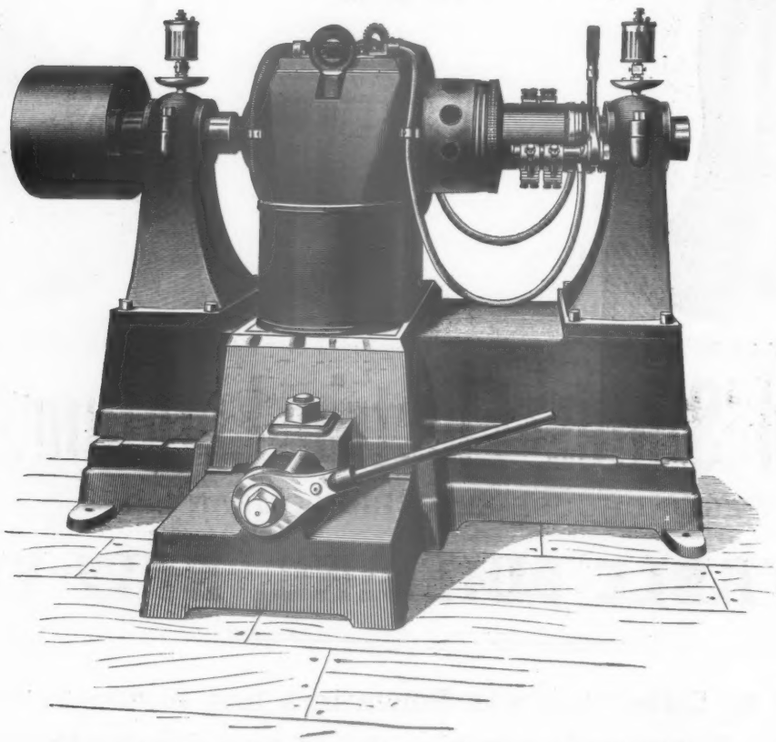

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C	8	.....	.....	.....	6.5	1¼	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
C	16	.....	.....	.....	12.0	2¼		780
C	.....	20	.....	.....	12.5	2¼		780
C	.....	.....	26	.....	13.0	2¼		780
C	20	.....	.....	.....	15.0	3		900
C	.....	25	.....	.....	15.0	3		900
C	.....	.....	32	.....	15.0	3		900
C	.....	.....	.....	50	16.0	3		900
C	28	.....	.....	.....	21.0	4½		1,360

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,000 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
C	.....	.....	45	.....	21.0	4		1,360
C	.....	.....	.....	70	21.0	4½		1,360
C	40	.....	.....	.....	29.7	6		1,750
C	.....	50	.....	.....	30.0	6		1,750
C	.....	.....	64	.....	29.5	6		1,750
C	52	.....	.....	.....	38.0	8		2,290
C	.....	65	.....	.....	38.6	8		2,290
C	.....	.....	83	.....	38.0	8		2,290
C	64	.....	.....	.....	46.5	10		2,770
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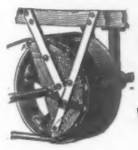
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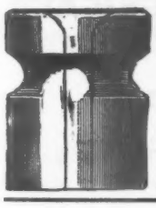
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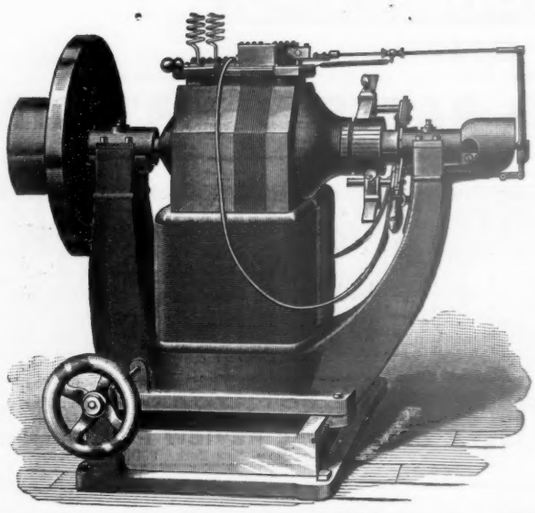

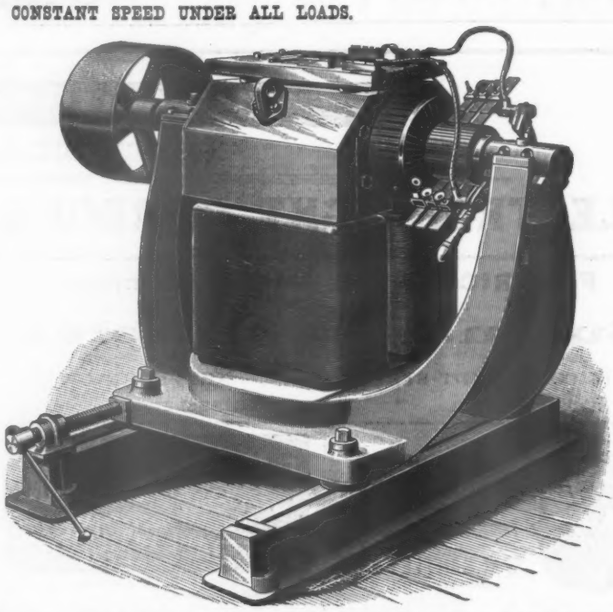

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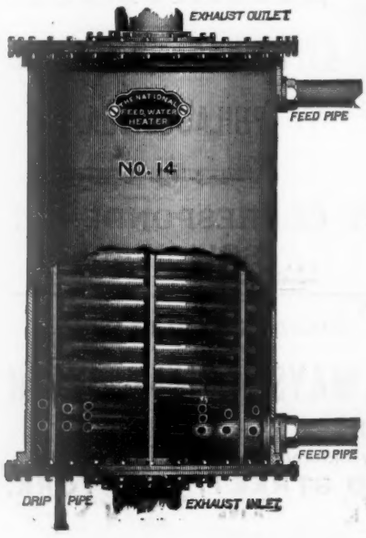

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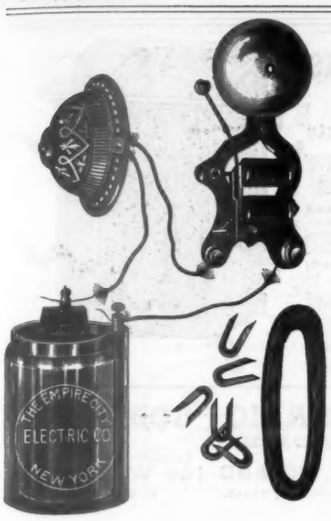

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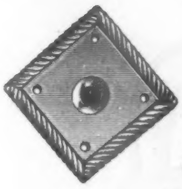

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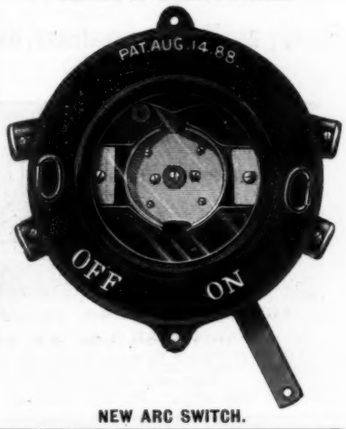

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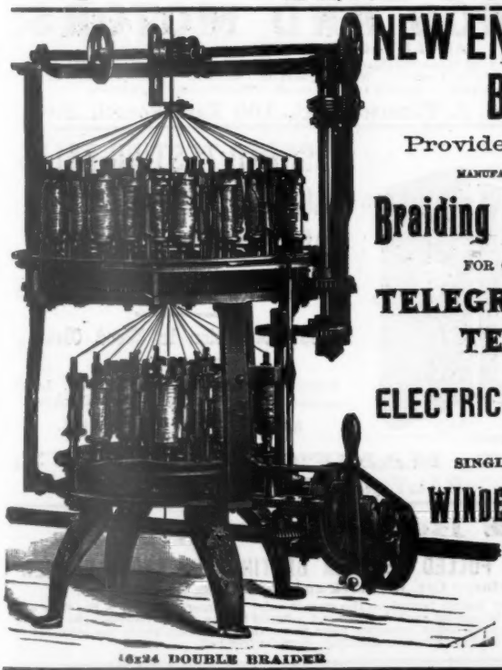

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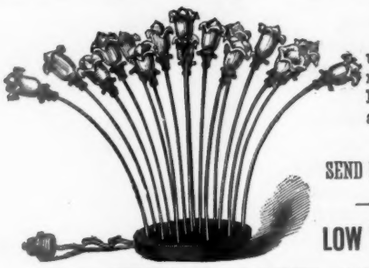

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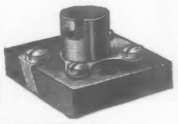

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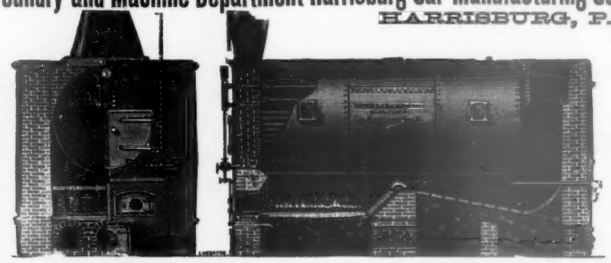

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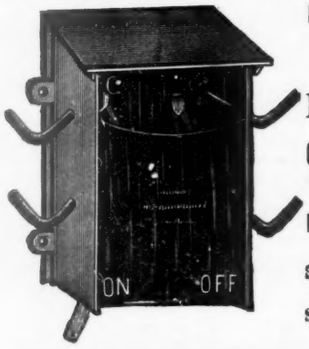

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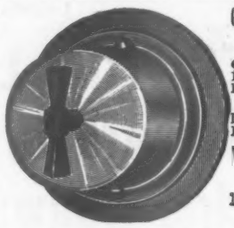

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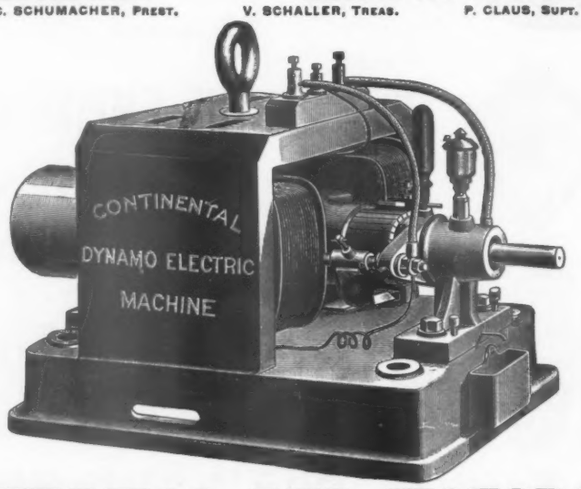

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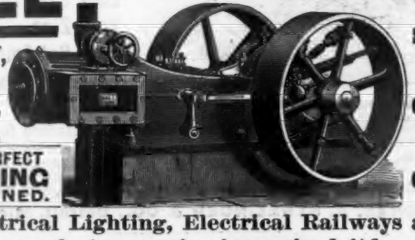

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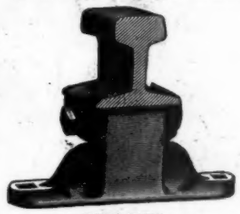

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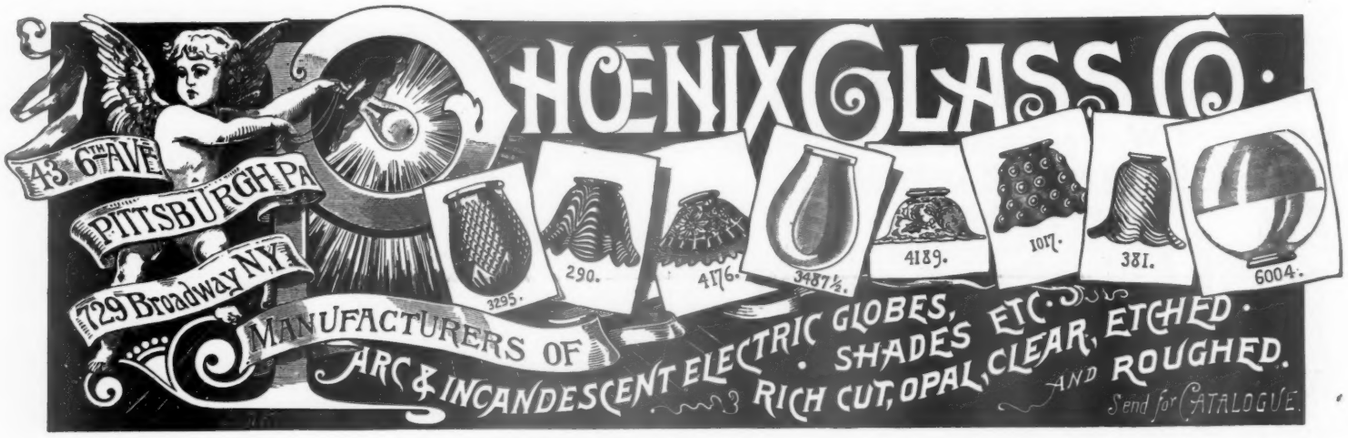

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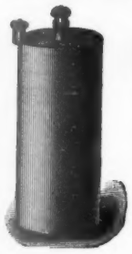

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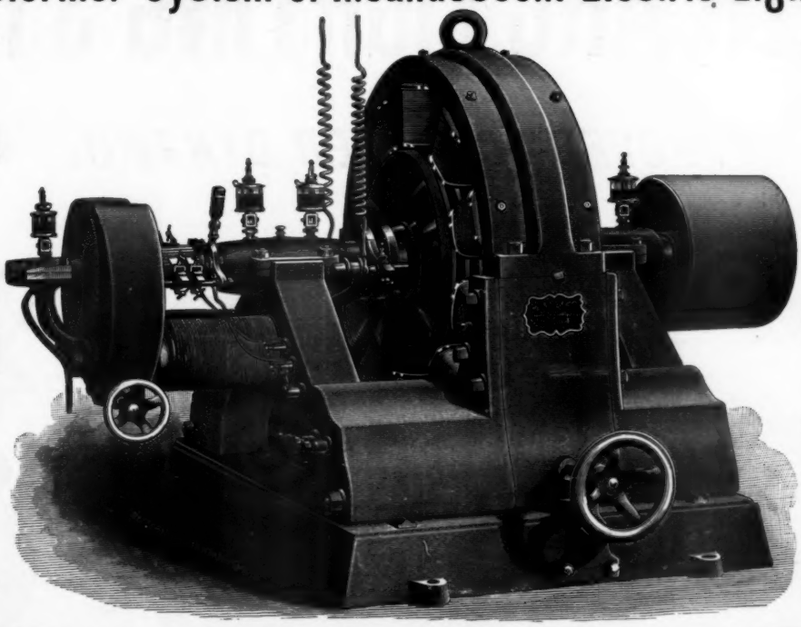

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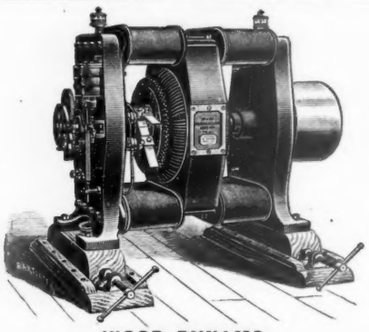

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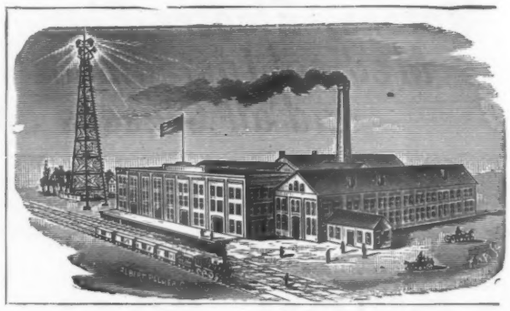

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